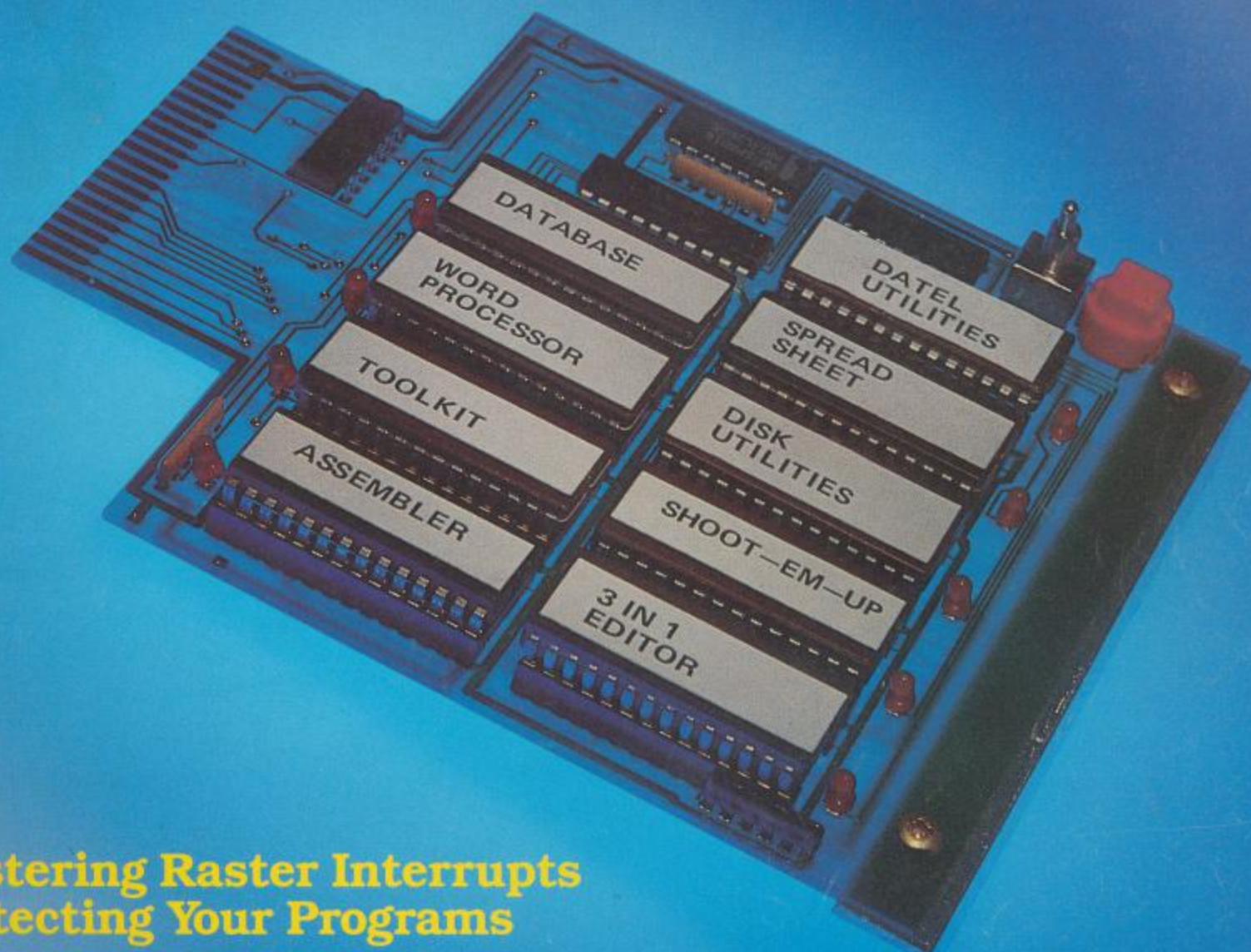


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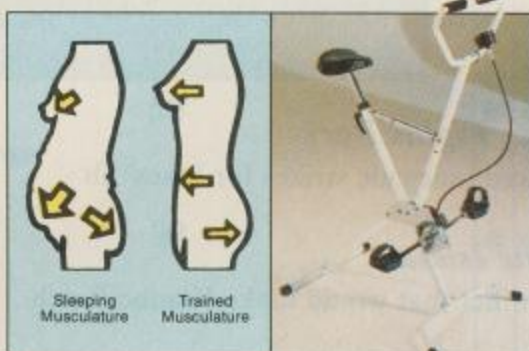
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## FEATURES

- ***A Bit on the Side*** 10  
Expand your horizon with Dattel's SuperRom Board
- ***Mastering the Raster*** 14  
How to hook your interrupt onto the screen scan
- ***Bombuzal*** 17  
Blast your brains out with Image Works
- ***Daley Thompson's Olympic Challenge*** 20  
Daily exercises for the joystick wagglers
- ***Assemblers*** 22  
What are they, where are they and how much do they cost?
- ***Foxx Fights Back*** 26  
The red renegade strikes for foxes' lib
- ***Battle Island*** 28  
A conflict that would make Rambo flinch
- ***Red Storm Rising*** 34  
Use your sub and follow the bear
- ***Ultima IV*** 41  
No meagre challenge for Amiga owners



- ***Structured Program Design*** 44  
More about the Top Down method of program planning
- ***Programmer Profile*** 51  
Tony Crowther and Dave Bishop, Image Works' dynamic duo
- ***Pools of Radiance*** 57  
A shining example of a roleplaying game

[illegible]







# DATA STATEMENTS

## Pac-Man Bounces Back

As a follow up to Pac-Land, GrandSlam are now poised for a burst of Pac-Mania.

In his new adventures, Pac-Man is back in the maze world but this time it's a 3D scene and the popular title hero can bounce out of trouble. The ghosts are still haunting the maze but Blinky, Pinky, Inky and Clyde have recruited two new characters, Sue and Jumpy, to help drive Pac-Man dotty.

Pac-Mania attracted a lot of attention at the recent PC Show and will be available for the Amiga (£19.95) and C64 (£9.95 cassette and £14.95 disk).

### Touchline:

**GrandSlam Entertainments**, 12-18 Paul Street, London EC2A 4JS. Tel: 01-247 5413

## Active Try Kipling

Active Distribution, whose *Hardball* showed the Americans how baseball should be programmed, have now signed a deal which gives them the marketing and distribution rights to Coktel Vision's software range. The French company currently hold two important licences for Walt Disney products and Active's Managing Director, Richard Stallibrass, was delighted to successfully negotiate and close the deal in the competitive atmosphere of the PC Show.

The two licences are for Kipling's *The Jungle Book* and Barrie's *Peter Pan*, two of Disney's largest grossing cartoon feature films. Future titles will also include *Freedom*, *Terrific* and *Emanuelle*.

Stallibrass's company has also been actively signing up the German

software house EAS whose *Zero Gravity* is currently receiving rave reviews in their home country. *Zero Gravity* is a cross between tennis and pinball in space and will cost £9.95 and £14.95 on C64 cassette and disk or £19.95 on the Amiga.

Also from EAS, we will be hearing and seeing *Ultimate Soundtracker*, a music utility with a choice of 127 instruments. The program is designed for both amateur and professional programmers who wish to add music to their programs without taking up too much memory.

### Touchline:

**Active Distribution**, Greyhound House, 16 Greyhound Road, Hammersmith, London W6 8NX. Tel: 01-381 2757.

## Braybrook's Back

Andrew Braybrook, Hewson defector and author of *Paradroid*, *Uridium* and *Morpheus*, has produced *Intensity* for British Telecom's Firebird label. The game involves rescuing colonists from the beleaguered Canis Major space station, orbiting Sirius.

The gameplay sounds like a development of the old standard *Defender* arcade game, as you have to rescue the colonists before they are captured by invading aliens and mutated into living bombs that will explode when you try to pick them up in your drone ship or skimmer.

Available for the C64, the game costs £9.95 on cassette and £12.95 on disk.

### Touchline:

**Firebird Software**, 74 New Oxford Street, London WC1A 1PS. Tel: 01-673 5373.

## European Arts

Electronic Arts has been busy signing up the best of mainland Europe's software houses. Spain's Dinamic and France's Ubi Soft have both recently signed distribution deals with the British branch of the American company.

Electronic Arts will be responsible for the European marketing of Dinamic's products except for Spain, Portugal and Italy. The Ubi Soft contract is a reciprocal agreement to handle the sales of the company's products in the UK and Eire in the same way as Ubi Soft have been handling EA's output to Europe.

Dinamic has already had success in the UK charts with *Game Over* and *Army Moves*, previously released through Imagine Software. On behalf of Electronic Arts, its Director of European Publishing, Mark Lewis



EA's Mark Lewis lends a hand to Pablo Ruiz of Microdigital Soft/Dinamic.



### Munster Release

The budget software houses seem to be racing to branch out into the full-price market. The latest contender for the big ackers brigade is Alternative, whose sister label Again Again bursts onto the scene with a major license to produce the computer game based on *The Munsters* TV series, which has recently been successfully pulled out of mothballs by Channel 4.

The programming team responsible for the game is Teque, an offshoot of Gremlin Graphics, currently enjoying independent success with titles such as *Terramex* and *Pac-Mania*.

The TV series features an average American family of assorted monsters who think that they are normal and the rest of the world is ugly and weird. Head of the family is Herman Munster, a Frankenstein clone, who is both clumsy and befuddled. His wife, Lily, is the daughter of a vampire, Granpa, who spends most of his life in the basement laboratory mixing up trouble for Herman. With parents like Herman and Lily, it's no wonder that their son, Eddie, is a crazy, mixed-up werewolf. The final member of the family is Marilyn, an orphaned cousin, considered hideously ugly by the rest of the family.

The game, scheduled for release in mid-November, is available for the C64 (£9.99) and the Amiga (£24.99).



*The Munster clan*

This month's award for strangulated prose goes to the author of the Munsters' press release. Sort this one out. "Q: What do you get when you combine the freshness of a new full-priced software label, but which is the sister company to the UK's most successful software house this summer (according to Gallup) with one of the most popular TV programmes

amongst computer games players at present, with one of the leading programming teams in the country?" How about, "A: Confused!"

#### Touchline:

**Again Again, Units 3-6 Baileygate Industrial Estate, Pontefract, West Yorkshire WF8 2LN. Tel: (0977) 797777.**

said, "Naturally we are delighted to have signed Dinamic as one of our affiliated labels. We were attracted to the professionalism Dinamic has shown both in the quality of its products and by the high standard of its marketing."

Of the Ubi Soft deal, Lewis goes on to say, "Ubi Soft's products are of a high quality and perfectly suited to the UK market. We are looking forward to working towards chart success with Ubi Soft's titles."

The first release from the new signings will be *Game Over II* from Dinamic and Ubi Soft's *Iron Lord*, *Skateball* and *Puffy's Saga*.

#### Touchline:

**Electronic Arts, 11-49 Station Road, Langley, Berkshire SL3 8YN. Tel: (0753) 49442.**



*Konix director, Sandra Holloway, practices levitation on the new Predator.*

### Konix Sticks Out

Two new joysticks have been launched by Konix ready for the Christmas market. As desktop units, the *Predator* and *Megablast* are a departure from the hand-held *Speed King* design which has placed Konix firmly at the forefront of the joystick market.

The *Megablast* is a smaller, budget version of the *Predator*. The *Megablast* (around £8) has bubble switches and a gearstick style handle but the *Predator* (around £13) features microswitch operation with a moulded handgrip handle.

The new sticks are intended as a complementary line alongside the *Speed King* range rather than as a replacement for them.

#### Touchline:

**Konix Products, Unit 35, Rassau Industrial Estate, Ebbw Vale, Gwent, Wales NP3 5SD. Tel: (0495) 350101.**



## Trilogic Open Up

Trilogic have extended beyond their mail order services to include a new computer showroom at their Bradford premises. On sale in the Trilogic Shop is the full range of Trilogic Commodore utility software and hardware, plus C64 computers, 1541C disk drives, Amiga 500 and 2000 machines. For the Amigas, there are also MS-DOS bridge boards, external floppy and hard drives, laser printers and a host of other add-ons.

The company also has a range of Commodore PCs at 'very competitive' prices and can supply all of the leads and connectors for the full range of products.

Trilogic's shop is open from 8.00am to 6.00pm Monday to Wednesday, from 8 till 8 on Thursdays and Fridays, and from 8 till 5 on Saturdays.

### Touchline:

**Trilogic**, Unit 1, 253 New Works Road, Bradford BD12 0QP. Tel: (0274) 691115.

## Daley Doesn't

When Daley Thompson lends his name to a project such as Ocean's Olympic Challenge game, he likes to get involved in the action. On a recent visit to check up on the progress of the game, before leaving for his ill-starred visit to Seoul, Thompson was so impressed with the advancement in graphics quality since *Daley's Decathlon* that he wanted to know all about the system used to create the realistic graphics.

The Ocean team have been liaising closely with Thompson so that the scoring system is as accurate as possible and his points book has been on loan to Ocean for reference purposes.

Unfortunately, the Decathlon star failed to fulfill a nation's hopes by only achieving a disappointing fourth place in the Olympics, despite an encouraging and impressive performance in the 100 metres event. Perhaps a workout in the Ocean game's gym would have helped to improve his performance.

For our view of *Daley Thompson's Olympic Challenge*, see our review in this issue.

**Touchline:** Ocean Software, 6 Central Street, Manchester M2 5NS. Tel: 061-832 6633.



Telecomsoft's stand gets the finishing touches from 'Goldie'

## PC Show

As computer shows go, the PC Show was a great amusement arcade with more promises than realities. In other words, the major companies went for the ultimate hype of providing the arcade machines and leaving the visitors' imaginations to run riot over the excellence of the forthcoming computer versions. Hype, hype, hype!

There was so little finished software available that I swore I'd refer to the show as exhibiting SOTWARE because there was no f in software. The three top-tips for the Christmas number one slot were Thunder Blade from US Gold, Afterburner from Activision and Ocean's Operation Wolf, but very little evidence of the software versions was available. Time will tell.

The game which got everyone buzzing probably won't make the top ten because, at the moment, it's only available for the ST. It's name is *Weird Dreams* and it is surreal madness from British Telecom. The gameplay is pretty understated but the concept is so totally OTT that it has to be an ST hit and I hope we'll see an enhanced Amiga version soon.

This year's show was held at the new Earls Court venue and most people I talked to seemed to be of the opinion that the atmosphere at the old venue, Olympia, was preferable. The frantic atmosphere of the Leisure Hall and the hallowed atmosphere of the Business Hall were separated by the Central Hall, which seemed to be a

mishmash of hardware and computer manufacturers, software houses, publishing houses and business software manufacturers. There was a special section for Taiwanese companies but with very few takeaways in sight.

Commodore's stand stood like a large, black mausoleum in the middle of the Central Hall. Its fortified exterior looked foreboding and uninviting compared to the Atari stand, which I found that I'd walked through without even noticing!

Elitism was the watchword, with US Gold building an impenetrable and unavoidable citadel beside a more open display area. Mirrorsoft had an impressive spaceship stand which would have stolen the show had the organisers layed on a suitable power supply for their dry-ice, mist machine!

Electronic Arts and Mediagenic (Activision) went to the lengths of avoiding the public by hiring hotel suites and ferrying journalists and lesser notables to their private venues by limousine. On the first day there were nasty scenes as chauffeurs vied for parking spaces, holding up the traffic and their fists in their eagerness to please their employers. For my part, I struck a blow for anti-elitism by arriving at EA in a taxi and plunged to travelling in a mini-bus to Mediagenic's venue.

Overall the 1988 PC Show left the body satiated in food and alcohol but the spirit thirsting for more tangible Christmas fare.



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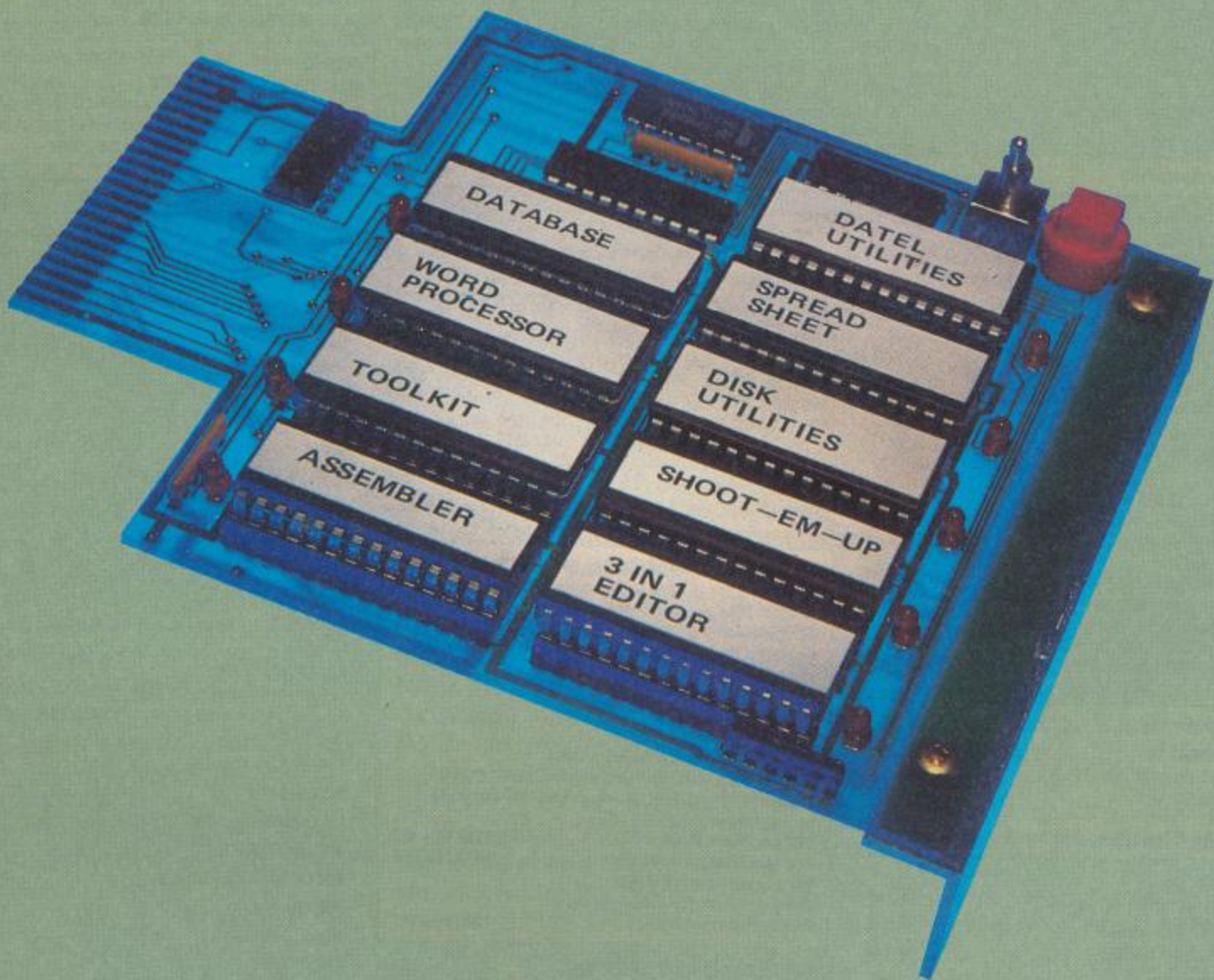
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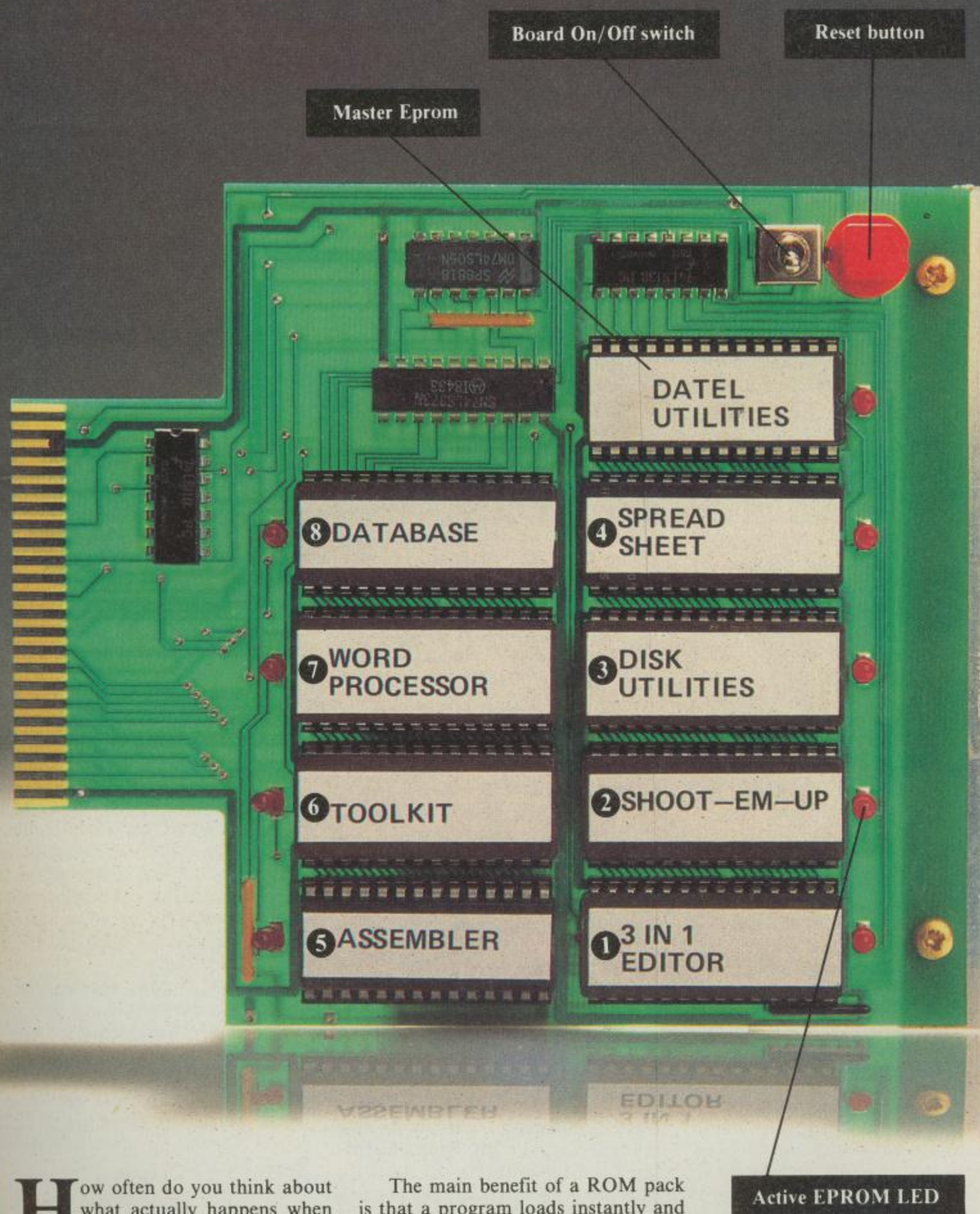
*By Kerry Fowler*

# A BIT ON



# THE SIDE





**H**ow often do you think about what actually happens when you plug in a cartridge? Probably never, because this is one of the least documented but potentially most useful facilities which the C64 and C128 offers.

The main benefit of a ROM pack is that a program loads instantly and the main applications these days are for backup (nudge, nudge) cartridges and the occasional game cartridge. This belies the true potential of ROM expansion and the area of do-it-



yourself expanders has only really been explored by Datel's range of cartridge constructors and the SuperRom Expander Board.

The SuperRom system is amazing because up to 256K of extra programs can be recalled almost instantly via the cartridge port. The programs are stored on eight EPROMs supported by Datel's own indexing and programming chip. The EPROMs may be 8K, 16K or 32K capacity or any mixture of these types.

The only problem with this lies, not in the expander, but in the operating system of the C64. Cartridges are expected to occupy the \$8000 to \$9FFF region of memory and this 8K capacity means that the larger EPROMs have to be banked in two or four 8K chunks. To compensate for this the Datel on-board operating system has a banking facility.

### Making the ROM

To create a suitable EPROM for the board, there are two programs in the SuperRom on-board operating system but an EPROM blower is necessary to transfer the resultant disk-saved programs onto a chip. Eminently suitable and convenient is the Datel EPROM programmer, Eprommer 64 (£39.99), though any suitably interfaced EPROM blower would do.

The on-board EPROM generator is called up from the SuperRom menu by pressing the F5 key. This displays a secondary menu which allows directory display, the sending of DOS commands and the two program generators; one for machine code and one for Basic routines.

The Basic generator loads a specified file from disk and then allows the user to specify a load address. This means that relocated Basic programs, which leave the lower part of memory free for redesigned characters or code, can be reloaded at the correct address. For normal Basic programs a simple press of the RETURN key is all that is necessary.

The generator next formats the program for booting up from SuperRom and prints up the last memory location that was accessed. The top right corner of the screen is used to display the minimum EPROM value that will accommodate the program.

The screen then displays the three EPROM types ready for the user to specify which type of EPROM will be used. This is an important decision

because an 8K formatted program can be stored on any EPROM but the banking systems differ on each type. Fortunately, the generator will not allow the accidental selection of a smaller capacity EPROM than the minimum required.

Before being asked for a filename for the formatted file to be saved under, another decision has to be made. The SuperRom sits in memory at location \$8000 to \$9FFF. This means that the EPROM replaces this section of memory so that any program which coincides with any, or all, of these locations will not run unless the SuperRom is switched out. For Basic, this is rarely necessary.

Once the program is saved, it may be transferred to ROM and then plugged into the board ready for use.

Using the machine code formatter follows roughly similar lines. The program is loaded from disk, the start address entered and then an extra selection panel appears.

The first option asks if a RAM/ROM is to be generated. This is to allow the system to create files suitable for replacing the C64 operating system with a chip of your own. Even if you merely change the power-up message to display your name, this can be quite an interesting facility though not really applicable for use on the SuperRom board.

If the final EPROM is for inclusion on the board, the answer to both of the questions posed is 'no' and the memory shaping questions can be tackled. When these have been answered the program generator will input the value that you've given for location \$01 and the SYS location.

After this the process again follows the same steps outlined above for EPROM size selection, saving to disk and EPROM generation.

With both chips on the board, the start-up menu of the SuperRom operating system will change to display the names given to the two EPROM programs.

Selection of one of the programs is made by pressing the relevant number key from one to eight. Bank selection can be made with the F1 key, the EPROM generator returns by pressing F5 and the SuperRom can be switched out in favour of normal Basic mode by pressing F3. F7 displays a full EPROM directory which gives more information: the socket number on the board, EPROM type, the program name and type, location \$01 value, and

Value in \$DE00				
EPROM type	\$38	\$28	\$18	\$08
2764 ( 8K)	1	(1)	-	-
27128 (16K)	2	1	-	-
27256 (32K)	4	3	2	1

### EPROM bank selection system

the program SYS address for code routines or RUN for Basic programs.

Normal, autostart EPROMs which operate just like cartridges can be fitted to the board. Full instructions for creating these EPROMs are given in the manual, including a sample autostart routine.

### The SuperRom Experience

Using the board caused a few initial problems but these were ironed out by delving into the informative, if at times confusing, manual. The small booklet tends to be a little difficult to read if you don't understand how the cartridge system works. At first, I was a bit too ambitious and found that the best practise was to start with small, simple routines before building up to the longer, more complex program transfers.

Seasoned programmers should be able to get even more from the board because the potential for internal programming of a master chip to control the board is there for those who wish to investigate further.

An initial experiment with the board can be expensive because the SuperRom board costs £29.99, Eprommer 64 raises this to £69.98 and eight 32K EPROMs would produce a grand total of £105.98. This may seem expensive but it's a one-off charge because EPROMs can be removed and added to suit your purposes, and extra EPROMs only cost £4.50 each for 32K or £3.00 for 16K types.

An extra few pounds for an EPROM eraser would also be a good investment. Since Datel don't seem to provide one, you could try your local electronics supplier. Mail order suppliers, Maplin, have one in their catalogue for £49.95 but this particular eraser handles up to 40 EPROMs at one time.

### Touchline:

**Product:** 256K SuperRom Board.  
**Supplier:** Datel Electronics, Units 8/9, Dewsbury Road, Fenton Industrial Estate, Fenton, Stoke-on-Trent. **Tel:** (0782) 273815. **Machine:** C64/128 with disk drive. **Price:** £29.99.



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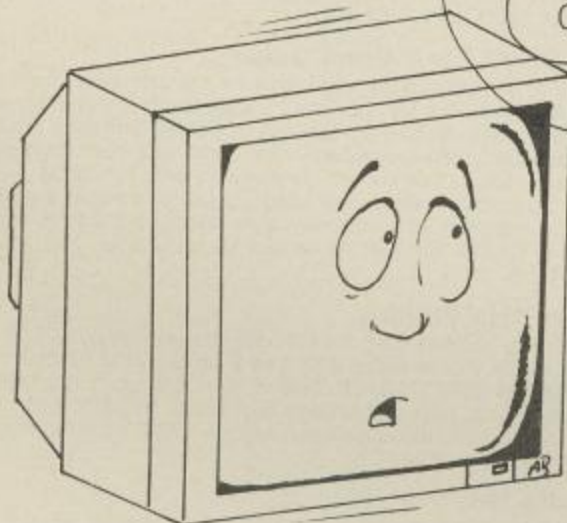
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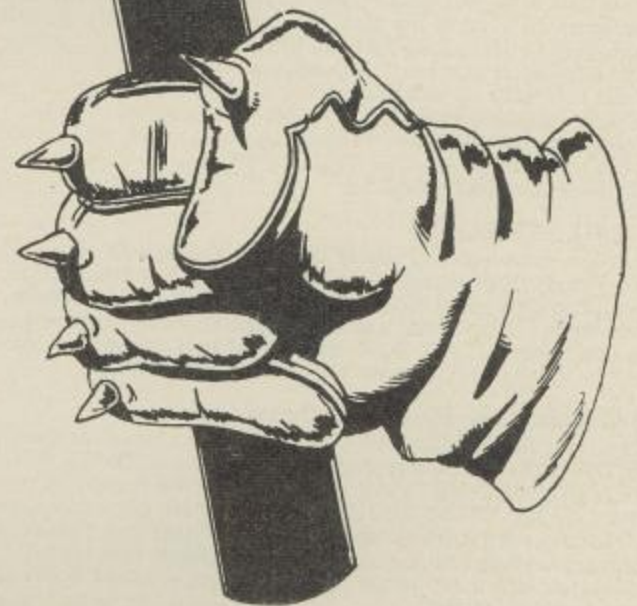
# Mastering The Raster

*What does it do?*



*What's a raster?*

*How do you use it?*



*We reveal all*

An interrupt is a short routine which is repeatedly executed during the main program but independently from it. Once the interrupt program (routine) has been dealt with (serviced), the main program continues as before. A simple allegory would be a man sitting at his desk, writing a letter when the telephone rings, he answers it and deals with the call, then he continues writing. In this example, the main task is the writing of the letter and the interrupt is the answering of the telephone. It is worth noting that an interrupt can influence or halt the main program through the alteration of memory loc-

ations, just as the telephone call could influence the man's letter.

An interrupt can be compared to a sub-routine but is much more powerful since it does not need any command in the main program to call it.

The Commodore 64 has four types of interrupt, which are;

reset  
NMI (Non-Maskable Interrupt)  
BRK (BRaK)  
IRQ (Interrupt ReQuest)

The interrupt we are interested in, the raster, is an IRQ interrupt. This is a

general term to describe *maskable* interrupts which simply means that they can be turned on and off using the following assembly language instructions:

SEI (SEt Interrupt flag)  
CLI (CLear Interrupt flag)

SEI is used to disable the interrupts, while CLI is used to enable them.

We can also determine which sources will trigger an IRQ and the four main ones are: sprite to sprite collision, sprite to background collision, light pen and raster line. We are only interested in the raster.



## What is a raster line?

A Commodore TV picture, or raster, is made up of 280 very fine lines. These are redrawn twenty times a second to create the impression of a moving picture. Each one of these lines is a raster line and a program can determine which line is being drawn by reading register 18 of the VIC chip, the raster register.

The top and bottom of the screen are usually around 30 and 280 respectively, although it varies on different TVs and monitors. The limits of the text screen, however, are always fixed at 40 and 240.

Here we see a problem, the raster line can be as high as 280 but the maximum number that a single register can hold is 255. An extra bit is needed so bit 7 of register 17 is used as the MSB of the raster line.

The VIC allows an interrupt to be generated when the screen display reaches a certain line. To cause this to happen correctly, we must first do three things:

1. We must tell the computer the screen line at which the routine should occur. This is done by writing the desired line number to register 18, the raster register, remembering to use bit 7 of register 17 as the MSB.

2. We must tell the computer that an interrupt is to be generated by the rasters when it reaches that line. This is done by using VIC register 26. This location is called the IMR (Interrupt Mask Register) and unless the bit which corresponds to the desired interrupt is set, along with bit 7, an interrupt will not be generated. The bits have the following significance:

- Bit 0 - raster interrupt
- Bit 1 - interrupt by sprite-background col.
- Bit 2 - interrupt by sprite-sprite col.
- Bit 3 - interrupt by lightpen
- Bit 4 - to 6 are unused
- Bit 5 - must be set if an interrupt is to occur

Therefore to inform the computer to generate an interrupt by raster, we would set bits 0 and 7 of the IMR. This could be done using the following commands:

```
LDA  %10000001
STA  IMR
```

3. Now we come on to a slight problem

which involves register 25, the IRR (Interrupt Request Register). This is used to indicate the source of an interrupt if more than one is active. If bit 7 is set then an interrupt has been generated and you can determine which type by checking bits 0 to 3 which have the same significance as in the IMR. However, the problem lies in the fact that if this register is not cleared by the interrupt routine then another interrupt will be generated as soon as the routine is finished and the computer will crash. The register can be reset by reading it and then writing the same value back to it like this:

```
LDA  IRR
STA  IRR
```

To recap, this is how to generate a raster interrupt at line 100:-

```
LDA  #100           ;store the line
                        number
STA  VIC+18         ;in the raster reg.
LDA  VIC+17         ;and erase bit 17
AND  #%01111111    ;set bits 0 and 7
STA  VIC+17
LDA  #%10000001    ;set bits 0 and 7
STA  IMR            ;of the IMR
```

The interrupt will now take place, and the first commands of the routine should be:-

Now you now how to generate an interrupt, but there are still some important things which must be explained, such as what happens during an interrupt and where the routines can fit in.

## What happens during an interrupt?

We have seen that, when an interrupt is generated, a routine is executed and then the main program continues, but we must let the computer know where the routine is. We do this by using the IRQ vector which contains the address of the interrupt routine. It is located at 788/789 (\$0314/\$0315) and usually contains the address \$EA31. This points to an address in ROM which checks the STOP key, increments the clock and flashes the cursor. If you

want these functions to continue, you must check the IMR to see if one of its sources generated the interrupt. If it didn't, the program should jump to \$EA31. The address of the routine is stored in the IRQ vector in normal lo-hi format.

When changing the IRQ vector, set the interrupt flag first and clear it when you are finished. If this isn't done, an interrupt may occur when only half of the address has been changed, the program would then jump to some unknown address and would probably crash.

Now that we can cause an interrupt and know how to generate one, the only thing which remains is to mark the end. This is done using the assembly language command RTI (ReTurn from Interrupt) but one more consideration must be taken into account. In order that the main program can continue unaffected, we must first save the registers by pushing them onto the stack (the program counter and flags register are saved automatically). This of course means that before we use RTI, we must first restore the registers by pulling them from the stack, as shown below:

```
PHA           ;save accumulator
TXA           ;then save
PHA           ;X-register
TYA           ;and finally
PHA           ;the Y-register
...
...           ;perform interrupt
...           ;routine
...
PLA           ;restore registers
TAY           ;making sure that
PLA           ;they are in the
TAX           ;right order
PLA           ;and then
RTI           ;return from
                interrupt
```

This is all the knowledge that is required to construct a raster interrupt, however, there are a few guidelines to programming them that you should be aware of.

Firstly, you need to write a short initialisation program. This will only be run once, and will be responsible for the setting up of the first interrupt. During this, the IRQ vector will be changed, the IMR written to and the raster line set. Do not forget to set and clear the interrupt flag during this.

Secondly, after saving the registers, you must have a program which will



determine which source has generated the interrupt and act accordingly. This is needed because there are the four sources we have already mentioned plus the system interrupt (the one responsible for flashing the cursor etc.). This program should also be responsible for clearing the IRR.

Thirdly, we write the interrupt routine, or routines, and at the end prepare for the next interrupt, before restoring the registers and returning. This preparation for the next interrupt is only the setting of the next raster line - the IMR does not have to be reset.

## Practical Examples

The first of the two example programs which I have included is very simple, but is a useful example of how the raster works. It allows three background colours to be used simultaneously and, though this can be achieved using extended colour mode, interrupts don't have the disadvantage of this mode.

The program works by changing the values in 53280 and 53281 when the raster reaches lines 0, 100 and 200. When you type in the program and run it, this can clearly be seen as you will now have a three-tone screen. The colours can be changed by poking locations \$C038 (49208), \$C04F (49231) and \$C056 (49238). Fig 1 shows how this routine works.

### Lines

80 - 200	These lines are used to set up the variables.
220	is the start address - \$C000 (49152).
240 - 370	This is the initialising routine which sets things up. It changes the IRQ vector to point to TEST.
400 - 460	This is the test to check that the interrupt is by raster line. Since, in this case, the only other possible interrupt source is the system interrupt, we branch to it if interrupt is not by raster.
480 - 500	These lines are the first test to determine the line. If it is greater than 100 the program jumps to test for the other two lines. Otherwise, it continues.

520 - 530	This sets things up for the main routine. The colour is put into the accumulator and the next raster line into the X-register.
540 - 570	This is the main routine where all the work is done. The already prepared value of the colour and raster are put in the proper places.
590 - 640	This restores the registers and returns from the interrupt.
670 - 740	These lines sort out the colours and raster lines for the COLOUR routines.

Another thing to note about this routine is that the main work section (lines 550-570) is only written once although in this case it is small. You should always try to make the main routine small with as little work to do as possible.

If you want to use this program as part of your Basic program, you can change the three colours by poking the colour into 49208 for the top colour, 49231 for the middle colour and 49238 for the bottom colour.

The second example is built around the same core, in fact line 10-500 are almost identical. This is because exactly the same procedures should be used each time.

The program gives 16 sprites simultaneously on screen. It works by copying the values from a table of sprite positions into the VIC registers when the line is at zero. Then, when the line reaches 130, new data is fetched from a second set of values. This is done continually so that the illusion of 16 sprites is created although the real number on screen at one time is actually eight. Fig 2 shows how this routine works.

### Lines

500 - 540	These lines prepare the registers for the main routine. The X-register again contains the next raster line number, but this time the address of TABLE1 is stored at locations \$FB and \$FC.
-----------	--

500 - 620	This is the main COPY routine. It sets up a loop and transfers the 16 values from the pre-defined table and copies them into the first 16 registers of the VIC. It then sets the raster for the next interrupt.
640 - 690	These lines are used to restore the registers.
720 - 770	These lines are used to prepare the registers.
720 - 770	These lines are used to prepare the registers when the other table of values is required. It works as lines 500 - 540.

Again, you will notice that the main routine is only written once and the registers are prepared for it. This is slightly more complicated than in the first routine but should not be too difficult to understand because the principles are the same.

To use the program from Basic, you must first load and execute it using SYS 49152. You then put the values of your sprite positions into the two different tables, in the same format as the normal registers. The tables are located at 49408 (\$C100) and 49664 (\$C200).

Now for the drawback of this method. Since the first set of sprites are switched out at line 130, any sprite from the first data set which crosses this line will be cut off at that point. For the same reason, any sprite from the second set which gets too close to the line will disappear completely.

The guidelines should be that, for set one, the sprite's Y co-ordinate should not be more than 108, and for set two, it's Y co-ordinate should not be less than 135.

This example is only a very simple one and you are free of course to copy the sprites' colours, pointers and anything else you feel like copying.

In this article I have presented the necessary information to write your own raster routines. I have also included two simple examples to help you get the hang of things and I think you'll find that, if you use the raster well, it can be an immensely powerful aid to programming.



# Bombuzal

Here I am on the kitchen floor. Well, I think it's the kitchen because there's plenty of tiles round here. Some are plain, some are rivetted, some have slots, others dissolve when you step on them and some are covered in ice. Whoops! Yes, it's definitely the kitchen. Who left the fridge open?

That's strange, I never noticed these funny ball-shaped things before. Mmm! smooth as a baby's ... Hello what's that ticking? I'm not hanging about to find out. Wow! That was close. Did you see that? It just blew up and took half the floor with it. Ah! another new tile what does this doooo...

...I see, it's a teleporter. Those nice people Dave Bishop and Tony Crowther never told me it would be like this.

I think it's starting to make sense. These balls are bombs and there appears to be three types: those that go whap when you touch them, those that need to be detonated and the last type which appear to be joined in some sort of suicide pact - set one off and they all go up.

Within these categories there are three sizes: small, medium and large. Oh! There's one over goodby world. Oh! keeps changing its mind. Large, medium, small, medium, large, medium - fickle creature. Here's a tile with a switch. I'll shut

After exploded, the number of tiles remaining is multiplied by ten and the result added as a bonus to the score. So, the aim is maximum havoc with minimum destruction. Careful use of the feature tiles enables the player to teleport, move certain bombs around along special

my eyes and pull it...nothing happened, or did it? I don't remember that tile being over there before. I think I'm getting the hang of this. Explode a bomb and you set up a chain reaction. If I plan it right I bet I could clear this room in no time. I'll just step on this rotating tile and...Aaaargh!

## Meanwhile...

Image Works' latest game is one of those puzzles which always seems to get critical acclaim but doesn't sell in vast quantities. The aim is to clear each room of bombs without blowing yourself up. Each bomb type behaves in a different way and the bigger they are the more havoc they create.

Immediately around each bomb is a devastation area and any tiles within this zone are totally destroyed. The blast from each bomb covers about twice the destruction area and any bombs within the blast pattern are also detonated. This can have a devastating effect on the scenery and, if care isn't taken, the disruption can prevent the completion of a level.

After exploded, the number of tiles remaining is multiplied by ten and the result added as a bonus to the score. So, the aim is maximum havoc with minimum destruction. Careful use of the feature tiles enables the player to teleport, move certain bombs around along special

grooves or animate Bubble and Squeek, two sacrificial robot helpers. There are two versions of the game, 3D and 2D. The 3D game looks very good in screen shots but is a real pig to play. Apart from appeasing the press, I can't think why it was included. Give me the 2D version any day.

As a diversion from the Christmas deluge of shoot-em-ups, it's nice to exercise the grey matter for once and with around 300 screens, my solitary brain cell will be stretched tighter than the skin on our paltry Christmas poultry.

Anorak-toting trainspotters may be interested to learn that screen 40 blasts down to spell the letters YCBM. Now who could that be?

Cheats might like to try working out when to press the CBM key, the fire button and then the RUN/STOP key and Q. Once you work that out, the plus and minus keys will take you to any screen you fancy.

A brilliant game but will genius reap financial rewards?

Karly Fowler

## Touchline:

Title: Bombuzal. Supplier: Image Works, Headway House, 66-73 Shoe Lane, London EC4P 4AB. Tel: 01-377 4645 Machine: C64. Price: £9.99 (cass) £12.99 (disk).



# Bombuzal



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# Daley Thompson's Olympic Challenge



**Touchline:**

**Title:** Daley Thompson's Olympic Challenge. **Supplier:** Ocean, 6 Central St, Manchester M2 5NS. **Tel:** 061-832 6633. **Price:** £8.95 (cass).

**D**aley is back, in a game launched to coincide with his attempt to become the only man to win three Olympic gold medals in the toughest event of them all, the Decathlon.

As everyone now knows he failed and had to settle for fourth place. However, he will still be regarded by many as one of the greatest athletes of all time.

Now you can better his performance, as Ocean, once again, is first off the blocks with an Olympic game. It was four years ago that Ocean released Daley Thompson's Decathlon and set into motion the whole sports' game bandwagon that company after company has jumped on. There was even a second Daley game, Daley Thompson's Supertest, but by then the Olympic fever was over but, now that it's back, Ocean is first off the blocks with Daley Thompson's Olympic Challenge.

Once more, this is a game that will test both you and your joystick, as the speed of waggle has a decisive effect on your chances of Gold by reaching the 9000 point total that will smash the world record.

However, it's now four years later and Ocean realise that a waggling game is no longer enough, so there are strategy elements thrown in to see whether your brain is still working, and you also have to get fit before the Games. These not only help the game considerably but also keep the various sponsors happy because the energy that you build up in the gym is represented by cans of Lucozade and the strategy element involves choosing the right sports' shoe for the job and, yes you've guessed, they are all Adidas shoes.

In the gym, you must work out at the weights and situps to build up enough strength and power to tackle ten gruelling events.

Soon, you're ready for the start of the 100 Metres. The gun fires and you're off. You waggle as fast as you can and cross the line in a disappointing 15 seconds. Your coach doesn't think you can win and so the game ends for you. Are you going to let this get you down? Of course, but soon you're back for a second go and this time you pick the right pair of unmarked shoes. Instead of running in a pair designed for high jumpers, you've got the sprinter's which let you fly, qualify and chalk up 900 points.

You'll need the same combination of waggling speed and skill to compete in the 400 Metres and the last event, the 1500 Metres, but you'll be pleased to know that you only need slow joystick movements to make the pace until the final, frantic sprint.

Timing is the important factor in the high jump, long jump, hurdles and pole vault, where you must waggle to build up speed and then press fire when you're ready to jump. As before, having the right type of shoes and building up enough strength in the gym is enough to carry you through.

Similarly, the javelin, shot and discus require speed in the wind up plus timing and power in the throw. As in all the events, the faster you move, the further you get and the more points you score, but if you don't reach a sufficient standard then the game will end.

Overall, Daley Thompson's Olympic Challenge is a worthy successor to the record-breaking game of four years ago and should test a few joysticks to destruction. If Daley is going to attempt another decathlon Gold in Barcelona, I'm sure Ocean will be training their programmers for Daley Thompson 1992.

**Tony Hetherington**



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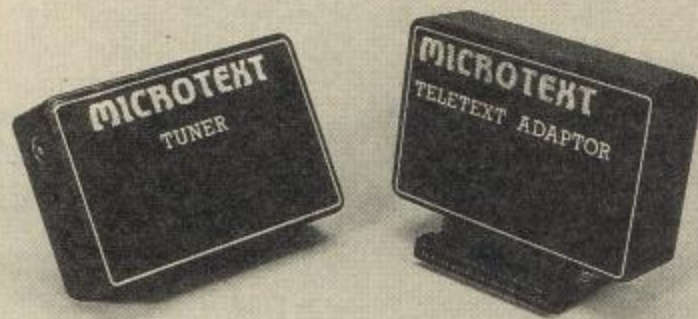
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# Choosing an Assembler

*Assemblers are essential programming aids so we offer  
counsel to the aspiring machine coder*

*By Gordon Davis*

**T**here's currently a tremendous revival of interest in high-level languages, particularly on fast, high-capacity micros like the Amiga. On these machines it's possible to run some very advanced compilers that will enable your C, Basic or whatever to run at C64 machine code speeds. This is cold comfort for people like us who are still hacking away on the C64. For us machine code is a must. There's certainly no other way to get those real-time speeds that we all crave.

If machine code is a must, then so is an assembler of some sort. Although there may well be some hardy people out there who are still programming in hex or on some tiny assembler, the only route to real productivity is to use a proper symbolic assembler.

## Talking to the Chip

As anyone knows, an assembler is just one way of rendering comprehensible the built-in binary instructions which

only the machine's CPU can understand, the 6510 in this case. All assemblers require the entry of a source code which uses three letter mnemonics for binary machine code instructions. These are then converted into machine-readable object code.

Beyond this, a wide variety of extra instructions can be added; some of which are essential, some not. I mentioned symbolic assembly, and this is definitely essential.

Firstly, symbolic assembly gives you the ability to assign values to alphanumeric labels which you can use later on in the source code as operands and so on. Values are usually assigned using the EQU (equate) statement at the start of the code. This means that the alterations need only be made in one place in the program to change it all.

Secondly, and probably more importantly, labels are vital when it comes to assigning flow of control within a program. Branch relative

instructions can be impossible otherwise. These have to have an operand indicating a jump of between +127 and -128 bytes from the instruction.

You really do not want to have to recalculate relative branches every time you change the program, so a symbolic assembler will allow you to assign a label to an instruction. When the source code is assembled, the assembler will automatically calculate the relative branch to that address and assign it to that operand.

## Knobs and Buttons

Like stereos, assembler programs may have all the knobs and buttons you need. Also like stereos, too many of these may simply confuse the beginner.

Look for the buzzwords: 'Two-pass'. This simply means that the assembler is symbolic - there's no way that you can assign values to labels without two scans through the source code.



One way to assess the strength of an assembler is the power and range of the 'pseudo-opcodes' that the assembler uses. We've already met one pseudo-opcode, namely EQU. It's a three-letter code, like LDA, PHP or any 6510 mnemonic, but it doesn't produce 6510 object code, merely tells the assembler to do something at 'assemble time'.

These codes are commonly known as assembler directives. All symbolic assemblers will have the directive EQU, but they vary widely with respect to others. A wide variety is possible when it comes to data opcodes. Supersoft's Mikro has only three data directives, WOR, BYT and TXT, which allow you to specify data as two-byte words, single bytes or strings. By contrast, Zeus64 has seven such directives.

## Monitors

Once you've written your source code and assembled it, you'll very likely want to debug it so one of the most vital extras is a monitor. Most assemblers do come complete with these but they vary vastly in their capacities.

A monitor may come with a small repertoire of commands: machine code load/save, step, trace, register dump, and so on. On the other hand, the Laser Genius Analyser is an incredible piece of software, hardly a monitor at all. It can even be programmed in a subset of Forth.

Mention of Laser Genius assembler brings us to two other buzzwords, macro and conditional assembly.

Macro assembly is a way of producing more compact source code. It allows you to set up a chunk of code that may be used more than once through a single keyword, which you can drop in wherever you want. The full listing is expanded out at assemble time.

Conditional assembly, on the other hand, means that you can set or unset switches in the source code, which enables you to control very closely which parts of the code are assembled at any one pass. Of all the assemblers I know, only Laser Genius supports both macro and conditional assembly.

## Getting one in

The trouble is, once you've decided

what you want from an assembler, there's precious little choice available these days. Historically, a very large number of assemblers have been produced for the C64, many of them excellent. The unfortunate thing is that most of them are no longer easily available although some remainders may still be found in the shops. This is due to the small margin involved in selling systems software. Companies that specialise in this area have a tendency to either move on or die.

As far as I can make out, the choice of easily available products comes down to just four products. There may be more but if I've left anyone out it's because they simply haven't bothered promoting the product properly. The four are Mikro from Supersoft, the catchily named YER6502ASM from York Electronic Research, the Merlin 128 assembler from Financial Systems Software and Speedy Assembler which is from none other than us, Your Commodore.

The Merlin C128 is a well-regarded C128 assembler which we reviewed a couple of issues back and there is a C64 version available in the US but not, as yet, in the UK.

I don't want to say a lot about Speedy Assembler, our product, except that it is, of course, powerful, very reasonably priced, bug-free (well almost), amazingly well-documented, and that every purchaser has the chance to win a night out with Stuart Cooke, the notorious bon vivant, raconteur, Your Commodore editor, and an incredibly wonderful and warm human being. This man is nothing short of a s... (That's quite enough - I feel sick. SUB-EDITOR).

Ahem. Seriously though, I can say that Speedy Assembler has one unique feature, namely a second symbol table which provides global references across a whole set of source files. In general form, it broadly resembles the late, lamented Zeus64 assembler.

Supersoft's Mikro may well appeal strongly to the first-time machine coder. It offers the convenience of being on cartridge and is simple, but adequate, and includes a monitor. The one drawback is the price, which is a little on the high side for this sort of product.

The YER product is considerably cheaper, but much more spartan. There is no monitor and a minimum of pseudo-ops and utilities. It is,

however, a true symbolic assembler and can be recommended to the beginner for its low price.

## Alas...

Just because a product isn't being marketed doesn't mean that you won't be able to find it. Copies may be gathering dust in a computer store or second-hand shop. Some excellent assemblers may turn up this way and I'd just like to mention three.

An honourable mention for the Commodore Macro Assembler, one of the earliest marketed and from Commodore itself, very usable for the price and still in use, as far as I can make out, by a large number of our readers.

My personal golden oldie is Zeus64, the one which I started out with. This has very clear documentation, and contains enough features to place it midway between simple beginners' packages and professional assemblers.

Laser Genius is one of the latter. This is an extraordinary package with every one of the bells and whistles you could want. LG is a tripartite package: assembler, monitor, and that Forth-based analyser I mentioned earlier. The assembler's got the lot, including macro and conditional assembly. I wouldn't recommend it for beginners but the 69-page manual is comprehensible if terse.

Look out for it - you may be lucky. The package was marketed by Oasis Software but it got dropped and disappeared recently. With some solid marketing it could have swept the field.

So there we are. Excellent as many of the currently available products are, they are, for the most part, not as sophisticated as the software of yesteryear. The message is to keep looking through those remainder bins.

## Touchline:

**Product:** Mikro Assembler. **Supplier:** Supersoft, Winchester House, Canning Rd, Wealdstone, Harrow. **Tel:** 01-861 1166. **Price:** £57.70.

**Product:** YER 6502 ASM. **Supplier:** York Electronic Research, The Fishergate Centre, 4 Fishergate, York YO1 4AB. **Tel:** (0904) 610722. **Price:** £12.99.

**Product:** YC Speedy Assembler. **Supplier:** YC Readers Services, ASP Ltd, 9 Hall Rd, Hemel Hempstead, Herts. **Price:** £6.00.



10 REM  
20 REM  
30 REM  
40 READ A  
50 NEXT A  
60 DATA 9,128,60  
70 DATA 178,170,2,90  
80 DATA 9,0,9  
90 DATA 8,26

10 GOTO  
20 FOR L=1 TO 100 NEXT L  
30 PRINT 'HELLO', GOTO 40  
40 PRINT 'MUM', GOTO 50  
50 GOTO 30  
60 DATA 10,20,179,180  
70 DATA 202,37,1,22  
80 DATA 52,30,66,1900  
90 RUN

EUREKA

*By Frank Carson*

The reasoning behind this program was to incorporate the *Serious User Guide* (1987) descender set into the Plus/4 wordprocessor and to combine the two programs. The Word-Pro Add On program uses the bit image printer mode to reform certain characters and the underline.

The new data is now in memory.  
Recheck the data and alter any errors

List 1 was published in the *Serious Users Guide 1987* as a basic program. (New characters on the MPS801/3) DESCENDER SET.) Listings of four other characters sets are supplied or you can design your own sets. Reprints will be available, details later.

Documents compiled using Nufont or the standard software are interchangeable. Using the standard software the underline instructions will be ignored.

For those of you without, Reprints of 'Wordpro Add On' (*Your Commodore*, February 1987) and 'New characters on the MPS 801/3' (*Serious Users Guide* 1987) are available as photocopies from our Readers Services Department at HALF PRICE! £1.50 gets you both articles (normally £1.50 each).

*See listings on page 62.*



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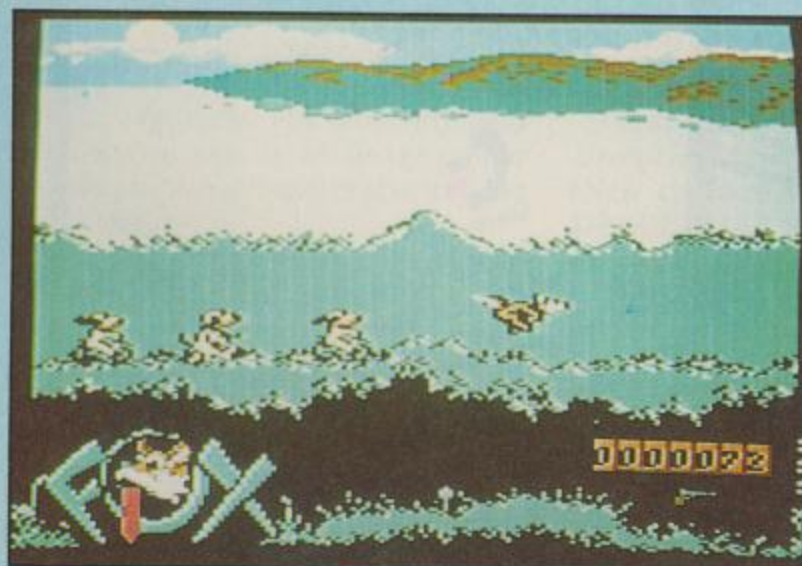


# Foxx Fights Back

If you're the kind of person who feels more sorry for the pursued rather than the pursuer, then this fox hunt may appeal to you. For the first time the fox gets the chance to answer back – with lead bullets!

Image Works and the programmers, Denton Design, seem to have had their wires crossed over the name of the main character. The packaging sports the name Foxx but the program seems to prefer the more orthodox spelling: Fox. Whichever is correct, the creature is still a mean son of a vixen.

Foxx and his partner are hungry so, armed only with a pistol, it's out of the safety of the den and into the cold, savage world. The world is depicted in superb graphics with parallax scrolling giving an added feeling of depth.



Along the way to his first meal, Foxx has to run the gauntlet past malevolent squirrels who are hurling highly explosive nuts down from the trees. As he progresses, the dogs from the local hunt pack swarm around – the Hell's Beagles have found him.

This is the little touch that makes the game. If Foxx outpaces these wretched hounds, they leap on their motorbikes and give chase. Like Foxx's animation, the frames for the dogs give a truly cartoon feel to the game. Full praise must go to Denton Designs who show all of their collective experience gained over years of programming the C64.

Blasting through the pack brings Foxx to the orchard where apples can be picked off the trees. There are only five of them but that's amazingly fortunate because our

hero can only carry that many. Now Foxx must go back to his lair to unburden himself.

At this point it is an advantage if all of the dogs have been wiped out. There is only a limited number of them and a strategem will help you out here. The best tactic, I discovered, was to gingerly approach the point where the dogs appear. The program seems to have a trigger point where the dogs are loosed and, by treading on this spot and jumping back, only a handful of dogs appear who are then easily wiped out with the pistol. Eventually, you reach that happy state where the onslaught stops and you have a clear path to the fruit and then on the return journey there are only the nutty squirrels to contend with.

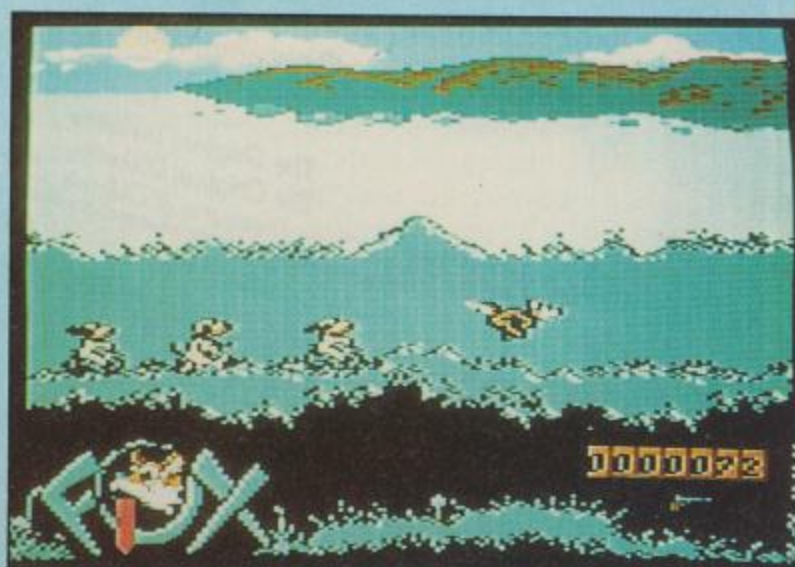
Back at the den, I really started to feel sorry for Foxx. His wife is a real tartar in the sense that she's an acidic source of discontent. After hubby has risked his life for a handful of apples, she sends him on his way with a flea in his ear. Even worse, returning empty handed results in a severe beating with a rolling pin. Absolutely no sympathy, if I were Foxx, I'd have left home long ago.

The next phase in the quest for food takes Foxx through the chicken shed. On the way, he passes a rabbit warren which is a handy source of food and a discarded rifle which has a greater range than his pistol.

Tactics in the coop involve leaping onto the nearest wall and blasting away. In this way, fewer chickens have to be shot and that means less likelihood of him being egg-sterminated by a barrage from these foul creatures.

Later in the game, he meets malevolent moles, a stream which must be crossed to reach the lair of the humans, but all the time there are dogs, dogs, dogs.

Foxx Strikes Back is a really enjoyable game to play



but I really must take the advertising department of Image Works to task. They recommend this game to hunt saboteurs as the way to turn the uneatable against the unspeakable. I'm sure that anyone who abhors unnecessary killing will be shocked by the mayhem that a fox armed with a sub-machine gun can cause. Red in tooth, claw and fur, this game is supreme entertainment.

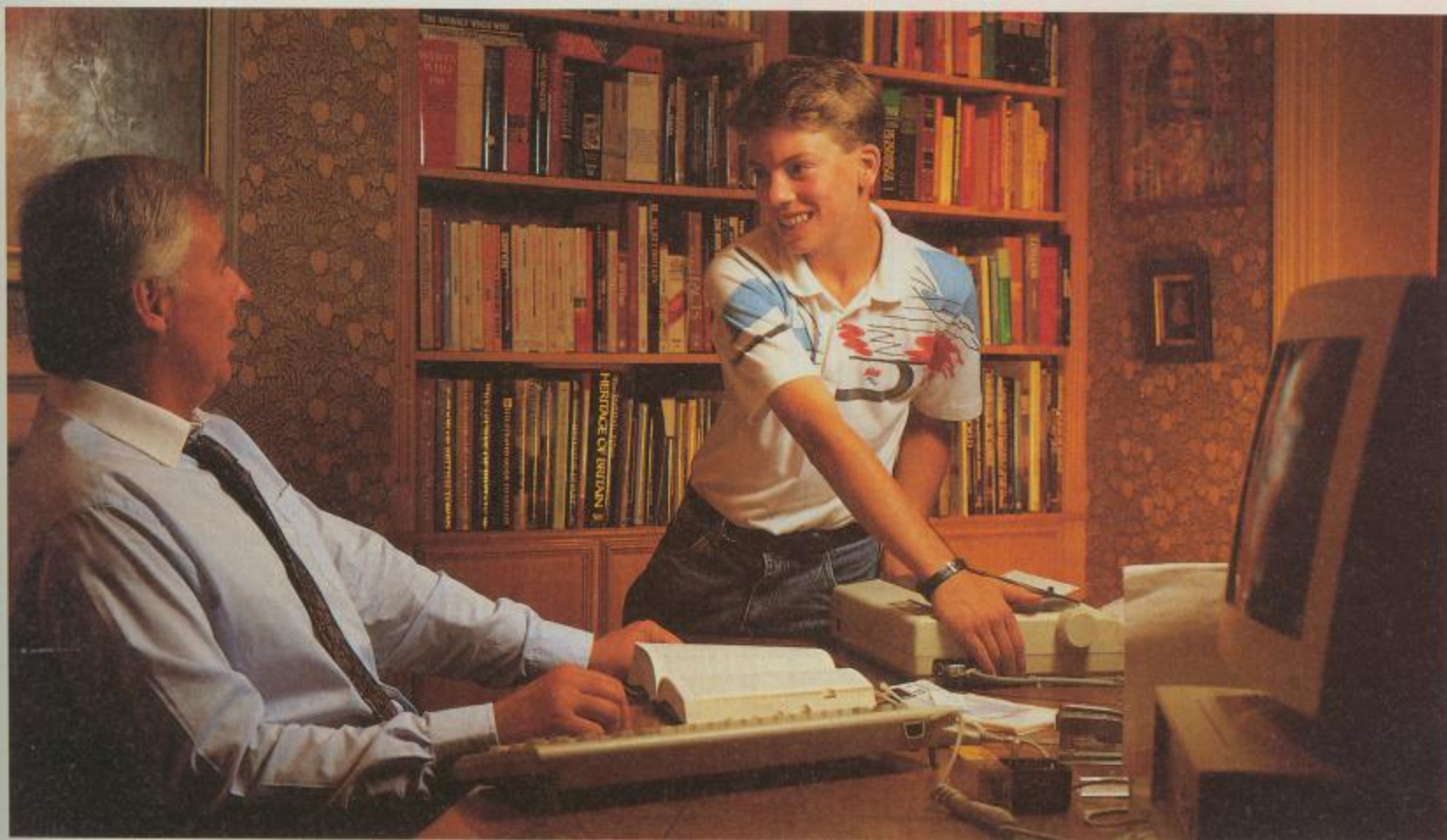
**Eric Doyle**

## Touchline:

**Title:** Foxx Strikes Back. **Supplier:** Image Works, Headway House, 66-73 Shoe Lane, London EC4P 4AP. **Tel:** 01-583 3949. **Machine:** C64/128. **Price:** £9.99 (Cass) £12.99 (disk).



# The day Daniel's dad brought his office printer home.



My dad's firm is always busy so he has lots of LC-10 printers at his office.

In fact, he sometimes has so much work to do that he keeps a personal computer in his study so he can bring work home.

But when he's really busy, he brings home one of those Star printers too.

Of course, I know exactly how to use them because we have the colour version at school.

It can print documents in six different colours.

So I'm not surprised WHAT MICRO? called the LC-10 the 'Best Budget Dot Matrix Printer' on the market.

What's more it's a lot less expensive than other printers but much better quality.

(My friend, Philip, even has one for his Commodore.)

For a start the front control panel is child's play.

The six different fonts give you so many different style options when you print things.

It's pretty fast too with a draft elite speed of 144 cps and high density near letter quality at 36 cps.

There's also the LC-10's special feature called 'push-tractor' which gives the lowest tear-off position of the paper.

And you can park continuous paper and automatically load single sheets – and I think that's unique for this sort of printer.

You know, if I keep my paper round going for a few more weeks I'll soon have enough to buy my own LC-10.

And then for a small fee, dad can borrow mine.



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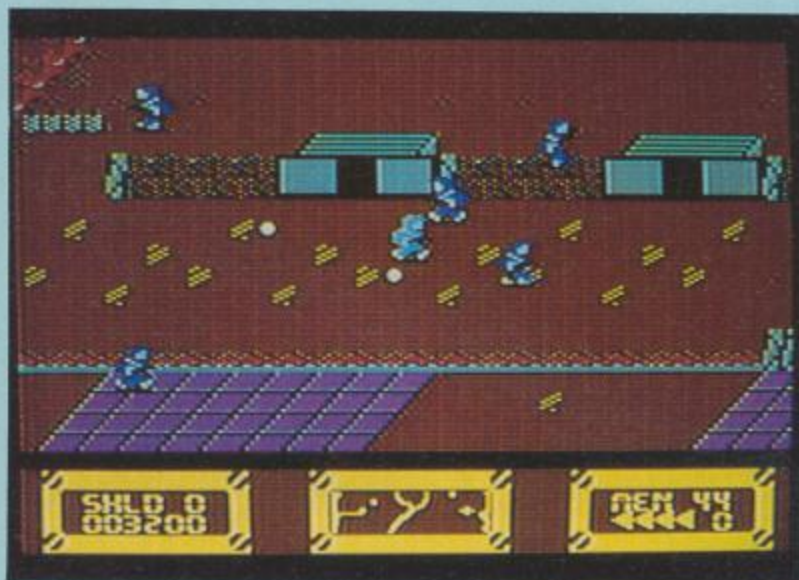
# BATTLE ISLAND

*Novagen have squeezed a quart into a pint pot – but does it taste as sweet?*

**N**ovagen don't do that many games as you may well be aware. Their first big hit was *Encounter* which fast became the definitive *Battlezone* clone. This was followed up by *Mercenary* which really showed what could be done in 64K.

Now comes *Battle Island* which departs from their usual style of game in as much as we have a more conventional birds-eye view, *Commando* style game with maze and adventure elements thrown in for good measure.

Sounds a bit run of the mill? Well yes and no. The scenario is certainly nothing new but the fact that there are 350 screens worth of scrolling action all of which is memory resident, thanks to a rather nifty data compaction system conceived by Paul Woakes and programmed in by Gary Walton. Still, enough background, let's take a look at what *Battle Island* has to offer.



## The Mission

The scene is set on a mid-Pacific Island where, presumably, some whacko scientist has built and stashed a Neutron Beam (gasp!) which will no doubt be used to get freelance cheques out of publishing houses quicker.

As is customary, vast teams of crack troops have been sent ahead of you but none of them made it back (of course) so lucky old you has been picked to save the day. So it's off in your little rubber dinghy onto Battle Island (daan-daan-dahh!).

All you get in the way of equipment is a gun and a map showing the general outline of the island and the small

enclave in the centre which is where the beam is stored. It's up to you to get round the maze-like island, find all eight pieces of a bridge which will allow you to cross the moat so that you can destroy this nasty weapon and make the world a safe place once more (!). Oh, and the other thing I forgot to mention was that there are also hostages on the island which need rescuing. All in all, you've got your work cut out for you.

Where does one begin on such a monumental adventure. Well, a good start is to have a close look at the map. This will give you a rough idea of scale and help you to avoid a few of the dead-ends caused by barbed wire fences, walls etc. Once you get the general feel for the terrain that lies ahead, you can start to play.

The game uses a single joystick which functions in the usual manner, the space bar fires off any smart bombs you may have accumulated and holding down the fire button activates any shields you've collected.

The backgrounds have a *Zaxxon* feel because of the way the perspective is depicted. The foreground characters are simple but adequate in depicting you, enemy troops and the various objects that you can pick up on the way. Most of these objects have distinct uses and one in particular is essential if you are to complete the mission.

Extra firepower is earned by shooting baddies. Once half a dozen or so are shot, one of the corpses turns into a star which, when picked up, increases your armament by a factor of one. Once three of these have been picked up you can have three bullets flying across the screen at the same time. Once a fourth star is earned you are equipped with a shield which, as you may expect, is jolly useful in panic situations.

As for game play, I can safely say that it's one of those games that will infuriate you enough to keep going, without being so difficult that you just want to throw the joystick, the 64 and your mum out of the window.

Death is not terminal in this game because you can start from the last electronic gate you went through in the next, and all future, games during that particular session. It's a shame you can't save and load positions into the game, as I can see a lot of players getting very peeved if their goal is almost in sight and they have to end the session for the day and go back to the start. I guess that's all part of a graphic adventure's appeal.

The disk version could also have had a high score table that saved itself to disk (as could so many games – come on guys it only takes a couple of blocks).

Audio effects are a bit naff too. The sound of you losing one of your energy units is the sort of thing you hear when a contestant on a game show gets a question right. Mind you, the music is quite good so I shouldn't really complain too much, should I?

All in all, *Battle Island* is an enjoyable game but not really the sort of thing we've come to expect from Novagen, though it does make a change from all the mindless shoot-em-ups and it's good to see one that actually requires a little thought.

**Kevin Crosby**

## Touchline:

**Title:** *Battle Island* **Supplier:** Novagen, 142 Alcester Road, Birmingham, B13 8HS. **Tel:** 021-449 9516 **Machine:** C64/128. **Price:** £9.95 (cass) £14.95 (disk).



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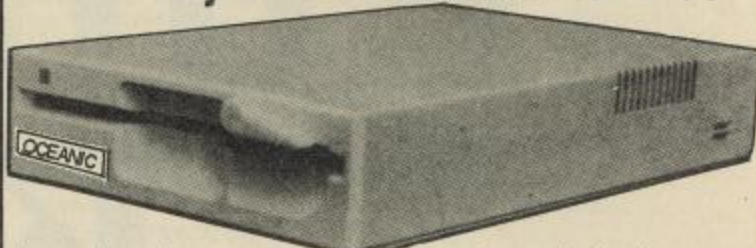
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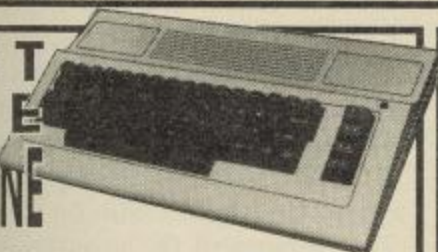
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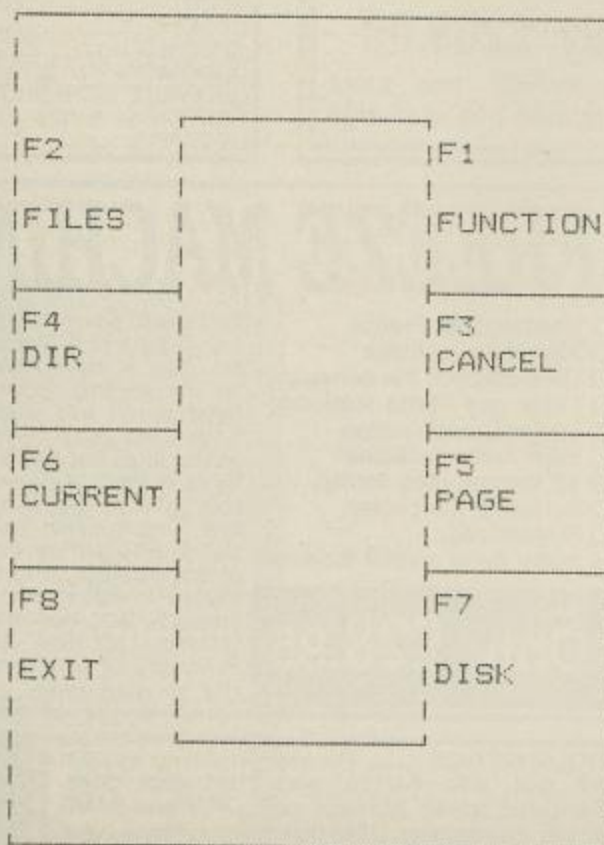


# Function Key Labeller

*Looking through pages and pages of an instruction manual to find out which function key does what is a thing of a past.*

**By  
Colin Howard**

*A printed label*



strip of paper under telling you everything you need to know.

In the past *Your Commodore* has published a function key template for the C64 that overcomes this problem. It used the 1520 printer plotter to draw a template that could be cut out and placed around the function keys. The operations of each key clearly marked.

Unfortunately 1520 printer plotters are now a little thin on the ground. This version of the program uses any Commodore compatible printer to produce a clearly labeled template.

## Using the program

The program is presented here as a Basic listing. You should type it in using our *Syntax Checker* (see Listings) to minimise typing errors. Once the program is typed in and saved simply RUN it.

When the program is started a screen offering options to edit the information to be printed is presented to the user. It is important to note that not more than 7 letters can be entered for each function key.

Because every make or model of printer is slightly different you may have to play around with the print statements that produce the template to get the best layout for your setup.

**T**he wonderful designers of the C64 blessed it with some extremely handy function keys – four of them in fact. These function keys have been put to a variety of different uses: they've been used to bring up pop-up menus; activate disk functions or even activate that wonderful thing, the smart-bomb, in shoot-

em-up games. The only problem is remembering which key does what.

Manufacturers of other computers with function keys obviously realised that this could be a problem and so catered for it. One shining example must be Acorn's BBC computer, this has a clear plastic strip above the function keys under which you can slip a



# commodore

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# Double Height

**W**hen you want to highlight something on your C64 monitor screen, the Commodore character set is somewhat lacking in impact.

The small program presented here changes the character set in such a way that a new double-height set is made available. Now important messages or game titles can be made to really stand out.

## Getting it in

The program is presented in the form of a Basic loader. Type this in using our Syntax Checker (see listings pages for more details). Once you have typed the program in save it to disk or tape **BEFORE** you run it.

The Basic Loader that you have just entered is designed to save the machine code for Double Height on your own disk or tape. Before you run the loader make sure that you have the disk or tape that you want the program saved to in the relevant device.

When you run the Basic loader, after a few seconds the prompt 'SAVE TO TAPE OR DISK' will appear. Choose the correct medium and the machine code will be saved. If you now check your disk directory or tape you will find that a new program DBL HEIGHT is present. This is the

*Enhance your text  
displays with an  
expanded character  
set.*

*By Clive Horner*

program that you should now use, the Basic loader can be forgotten about.

To produce double height characters you use a combination of SHIFT plus the letter that you require or the Commodore key and the letter you require. If you try this you will notice that *SHIFT + letter* produces the top half of the letter and *COMMODORE + letter* produces the bottom half of the character that you require.

You will, no doubt, realise that each line that you want to print in double height will have to be printed twice, once using SHIFT and then again a line lower using the Commodore key. To clarify this, let's say that you wished to print the letters ABC

in double height. A program to do this would look like the following:

```
10 PRINT "(SHIFTED A)
(SHIFTED B) (SHIFTED C)"
20 PRINT "(CBM A)(CBM B) (CBM
C)"
```

It is possible to make the top and bottom of your characters a different colour by using:

POKE 646, new colour

before each PRINT line.

## Using the program

When you want to use the DOUBLE HEIGHT program you should do the following:

Load the program DBL HEIGHT using:

LOAD "DBL HEIGHT", 8,1 if using disk  
or LOAD "DBL HEIGHT", 1,1 if using cassette.

When loaded type the following:  
POKE52,48:POKE56,48  
POKE 53272,29:CLR

The new double height character set is now ready for use.



# Can You Stop The Russian Bear?



Based on the NO.1 best-selling book Red Storm Rising by Tom Clancy; Larry Bond co-author. Copyright 1986 by Jack Ryan Enterprises Ltd and Larry Bond. All rights reserved.

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# Red Storm Rising

**B**ased on the bestselling novel by Tom Clancy, Red Storm Rising casts you as a US submarine commander on patrol just as World War III breaks out. Unlike other simulations of the war that, hopefully, will never happen, this is a non-nuclear version and assumes that disarmament worked, which is just as well because a nuclear war would be decided in only a few minutes.

War has broken out because the Soviets mounted an invasion into the Middle East after Islamic nationalist terrorists had blown up their Siberian oil fields. As the Russians massed on the border a clash between East and West was inevitable.

Although you were at sea when the hostilities began, you quickly realise what has happened when the missions you are asked to carry out become tougher and more frequent. As the game unfolds, you learn just how important your success or failure is to the outcome of the war.

Your craft is an American, nuclear-powered, attack submarine that's armed with MK48 torpedoes and Harpoon missiles (there are other subs available with slightly different weapons but the balance remains the same). The submarine is also fitted with the latest sonar and radar equipment and it is with these that you will stalk and attack your prey which varies between Soviet submarines wolfpacks, carrier task forces, or anti-submarine patrols with support fleets and landing craft.

You operate from your base at Holy Loch in the north of Scotland and into the Norwegian theatre of operations that stretches from the UK in the east to the Barents Sea in the west and from Iceland and the Arctic in the north down to mainland Europe. It is vital to the outcome of the war to cause as much damage as possible to the Soviet fleet as it tries to escape to the Mediterranean Sea and Atlantic Ocean. The more damage you do, the

more seriously you will damage its war effort.

The Norwegian Theatre also contains a variety of conditions that will challenge all submarine commanders, as you may have to fight a battle in deep water, shallow water or even in among the ice-floes in the north and the east. This will make an already difficult, cat-and-mouse game almost impossible.

Although the game is written by Sid Meier, author of F-15 Strike Eagle and Silent Service (in collaboration with Tom Clancy and Larry Bond), it is as different from the World War II action of Silent Service as you could imagine, because the end-around, attack tactics of then just won't work now.

One reason for this is the incredible ranges of the weapons in modern naval warfare, another is the accuracy of today's sonar and radar. Learning to use this well will determine the difference between success and failure.

The main screen of the game is the sonar display which remains blank until a contact is made. Each new contact appears grey until your sonar operator is certain that there is something there. A numerical display also shows the contact's course and speed (when this data has been determined), its bearing and the percentage of certainty. If this rating is over 70 per cent then you're almost sure there is something there and the colour on the screen becomes lighter. Over 90 per cent you can identify the class of ship, its speed and course, and you can then prepare your attack.

You have three ways of finding the enemy: towed sonar, active sonar and radar. Towed or passive sonar uses a range of equipment that you tow behind the submarine and can be disrupted by sudden manoeuvres or







FROM COMSUBLANT: "Congratulations on superlative effort. High enemy losses will significantly improve situation in this area. Unfortunately, contact data indicates the enemy was NOT, repeat NOT, your mission objective. Please continue current orders. Ends."

ER: 5000 HarDay: 33  
PACT NATO



0558 hours 07/17 1984

Captain, we have a sonar contact, bearing 303 degrees!

Navigation shows open water.

Your Orders, Sir?

General Quarters! Prepare for battle!  
XO, Report Ship Status  
Review Mission Orders  
Computer Log

changes in speed. This is the safest method because you can detect the enemy without them finding you. Active sonar is more accurate but will also reveal your position and radar only works for aircraft detection. To make things more difficult, all devices are affected by the sea conditions, thermal ducts, and your depth and speed. If you go too fast when you're too shallow, then your propellers will cavitate in the water, drown out the sonar reception and announce your position to the enemy.

Once you've found your enemy, you must plan your attack. Obviously, you will devise your own tactics and may wish to approach on the blind side of the destroyers when attacking a convoy but I prefer, and have had some success with, more direct tactics. Once I've tracked the enemy with passive sonar for a while, I launch a barrage of MK48 torpedoes at the destroyers in the group, setting them so that they don't surface until the last minute and therefore remain undetected. A quick course change brings a different attack angle and, after a short delay to reload all four torpedo tubes with Harpoon missiles, a second assault is aimed at the

destroyers. With a little practice, the results can be devastating, while you slope off to a new position, reload and wait to see what survives the Harpoon strike as it destroys, or at least damages, the support craft. The support ships or landing craft will then immediately bolt straight into the approaching, slower torpedoes.

Unfortunately, it doesn't always go exactly to plan and sometimes leaves you in a deadly, watery dogfight with a destroyer. You must avoid this long enough to allow you to reload with some of your limited supply of noise makers and decoys to distract any incoming missiles or torpedoes. Forget about the old tactics of hiding silently at the bottom, against today's sonar it just doesn't work.

At the end of the battle, you'll receive a report that will either congratulate you on your success, tell you that some got away or report that you were picked up after your sub was destroyed. You are then given a new command according to the gravity of the situation.

Next, a summary of the latest events in the war is displayed either as news reports or intelligence files, determined by your success or failure.

For example, if you didn't take out a landing force that was heading for Iceland, then this would turn red on the map showing that it has fallen.

This map is also used to control strategic movement and shows the reported positions of enemy surface and submarine groups. NATO spy satellites patrol overhead and plot the position of the enemy more accurately so you can close for attack. You can also use this screen when you need to return to Holy Loch for repairs or reloading and you can then collect any promotions or medals that you've been awarded.

If you don't feel ready for an entire war, you can take on individual missions at a variety of skill levels. Although the game has a few graphics sequences, such as when a missile hits an enemy ship, it lacks the graphic appeal of games like Gunship. Still, a must for those who like their action tense and exciting.

#### Touchline:

**Title:** Red Storm Rising. **Supplier:** Microprose, 2 Market Place, Tetbury, Gloucs, GL8 8DA. **Tel:** (0666) 54326. **Machine:** C64/128. **Price:** £18.95.



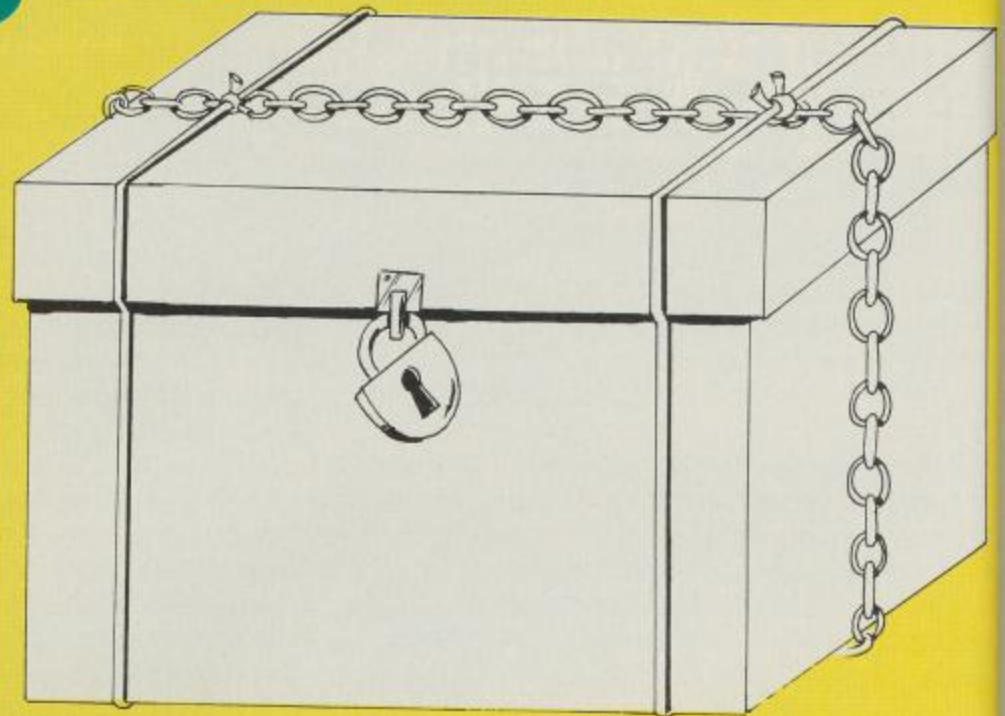


# Program

*Preventing your latest masterpiece from being listed and copied can be quite a problem.*

*We give you a few ideas on how to protect your work.*

**By F. Moane**



# Protection

**K**eeping prying eyes from looking at your latest program can be quite a problem. This article is an attempt to give a comprehensive guide to most of the methods of protection. All these methods are to stop your friendly neighbourhood hacker from breaking into your program.

Unfortunately it is almost impossible to stop a person from actually copying your work with the range of cartridges and nibblers available today. Anyway, have fun poking round your Commodore.

## RUN STOP/RESTORE

### Commodore 64

RUN STOP + RUN STOP/  
RESTORE

Disable: POKE 808,54:POKE  
809,188

Enable: POKE 808,237:POKE  
809,246

RUN STOP + RUN STOP/  
RESTORE + LIST

Disable: POKE 808,234  
Enable: POKE 808,237

RUN STOP + INTERNAL CLOCK

Disable: POKE 788,52  
Enable: POKE 788,49

RESTORE

Disable: POKE 792,193  
Enable: POKE 792,71

### Commodore 128

RUN STOP + RUN STOP/  
RESTORE

Disable: POKE 808,100  
Enable: POKE 808,110

RUN STOP

Disable: POKE 808,112  
Enable: POKE 808,110

RESTORE

Disable: POKE 792,100  
Enable: POKE 792,62

## Disabling other keys

SHIFT

Disable: POKE 657,0  
Enable: POKE 657,128

CBM/SHIFT

Disable: PRINT CHR\$(8)  
Enable: PRINT CHR\$(9)

WHOLE KEYBOARD (for joystick  
input etc)

Disable: POKE 659,0  
Enable: POKE 649,10

## Prevent Reset

There is a method to defeat a reset switch on the 64 or the built in switch on the 128. it simulates an autostart cartridge and is used only with a machine code routine, which is executed on a reset call.

Basic programmers could also use this method by pointing to a machine code routine which would run their program.



The locations are as follows:

**\$8000-\$8001** (32768-32769)

Start address of routine to jump to on reset in low byte/high byte format

**\$8002-\$8003** (32770-32771)

Address for the RESTORE key to jump to when pressed in low byte/high byte format

**\$8004-\$8008** (32772-32776)

Put the bytes \$C3, \$C2, \$CD, \$38, \$30, (195, 194, 205, 56, 48) into these locations. Values are ASCII for CBM80, the cartridge identifier code.

Some games authors define the RESTORE key to restart the program and the RESET to point to a warning message, or even a small game!

## Preventing List

If, by accident, your Basic program halts with an error, it is easy for a hacker to list the program. POKE 808,234 does the job of scrambling LIST but the methods discussed here are tougher to disable.

### The simple methods:

At the start of your program put a line with a REM statement followed by a SHIFTED L. The program will list with a SYNTAX ERROR.

This protection is easy to defeat, since not listing the line with the REM statement will reveal the rest of the program.

POKE 774,134:POKE 75,227

resets the computer once LIST is typed. If you use the reset protection, your program will restart. That should fool 'em!

### The more complicated methods:

Load in your program and PRINT PEEK(2049). Note this down and then POKE 2049,255. The program cannot be listed but will RUN correctly.

This method has a drawback as if there is a GOTO or GOSUB in the program to a lower line number, Basic gets confused. Before such an action, POKE 2049 with the value that you previously noted and remember to put 225 in 2049 when the GOTO or GOSUB is finished.

Add the following lines to your program exactly as shown.

```
0SYS2063
1*****
```

Now, enter the following string of POKEs in direct mode, each separately.

```
POKE2063,169: POKE 2064,26:
POKE 2065,133: POKE 2066,43:
POKE 2067,32: POKE 2068,89:
POKE 2069,166: POKE 2070,76:
POKE 2071,174: POKE 2072,167:
POKE 2059,0: POKE 2060,0
```

These POKEs are machine code to move the start of Basic to the start of your program. The last two POKEs set the end of program's 'two-nulls' to just after line 0. Feel free to disassemble the machine code.

The result of all this is a program that runs as normal, but lists as 0 SYS 2063

Practically impregnable!

## LIST Tricks!

LIST is a powerful command. A couple of one liners can modify it considerably.

POKE 774,0

This has the strange effect of listing only the line numbers of a program! This POKE could be placed in a loader program to protect the subsequently loaded main program.

POKE 22,35

An instant wordprocessor! Using the Commodore's powerful screen editor, text can be manipulated, printed and saved without a program. The method is to type your text as a BASIC program with line numbers. When finished, enter the POKE and the line numbers magically disappear!

## Autorun

Most Commodore owners will be familiar with the concept of chaining programs, ie, loading a second program from within the first. This has the advantage of automatically running the second program. Problems are sometimes encountered if the second program is longer than the first.

Using this method, protection can be set up in a short loader program so that interrupting the load would be impossible.

```
10 POKE 808,234:REM RUN
STOP/RESTORE
20 POKE 774,0:REM LIST
PROTECT
30 PRINT CHR$(147);
"LOAD"+CHR$(34) + "PROGRAM
NAME"+ CHR$(34)+",8,1"
40
FORX=1TO3:PRINTCHR$(17):
NEXT:
PRINT"RUN":REM LOAD AND
RUN PROGRAM
50 POKE 631,19:POKE632,
13:POKE633,13:POKE198,3
60 REM SET KEYBOARD
BUFFER WITH HOME AND 2
RETURNS AND QUEUE TO
THREE PRESSES
70 NEW:REM ERASES THE
LOADER AND LOADS THE
PROGRAM
```

I hope the REMs explain what the program does. This method is only useful if there is no printed material on the screen to be corrupted. Of course, the loader program itself can be listed. A REM SHIFTED L could cure this.

Programs are provided to illustrate two other methods of protection. The INPUT BUFFER program uses the input buffer to simulate a keyboard entry, without disrupting the screen.

The AUTORUN program is more sophisticated in that it uses machine code to alter your original program so that it always RUNs itself. Protection from RUN STOP/RESTORE is included and a message can be put on the screen.

To use this utility, have the AUTORUN program in memory and your Basic program on disk. When asked for a message, enter the text that you wish to be displayed before your program runs. Input the name of the old program, and a different name for the autostart version.

Obviously, the new program will take slightly more space on the disk. However, if you use the protection methods in this article, you will have a program which autostarts, defeats RESET switches, is impossible to stop, and restarts when LIST is typed!

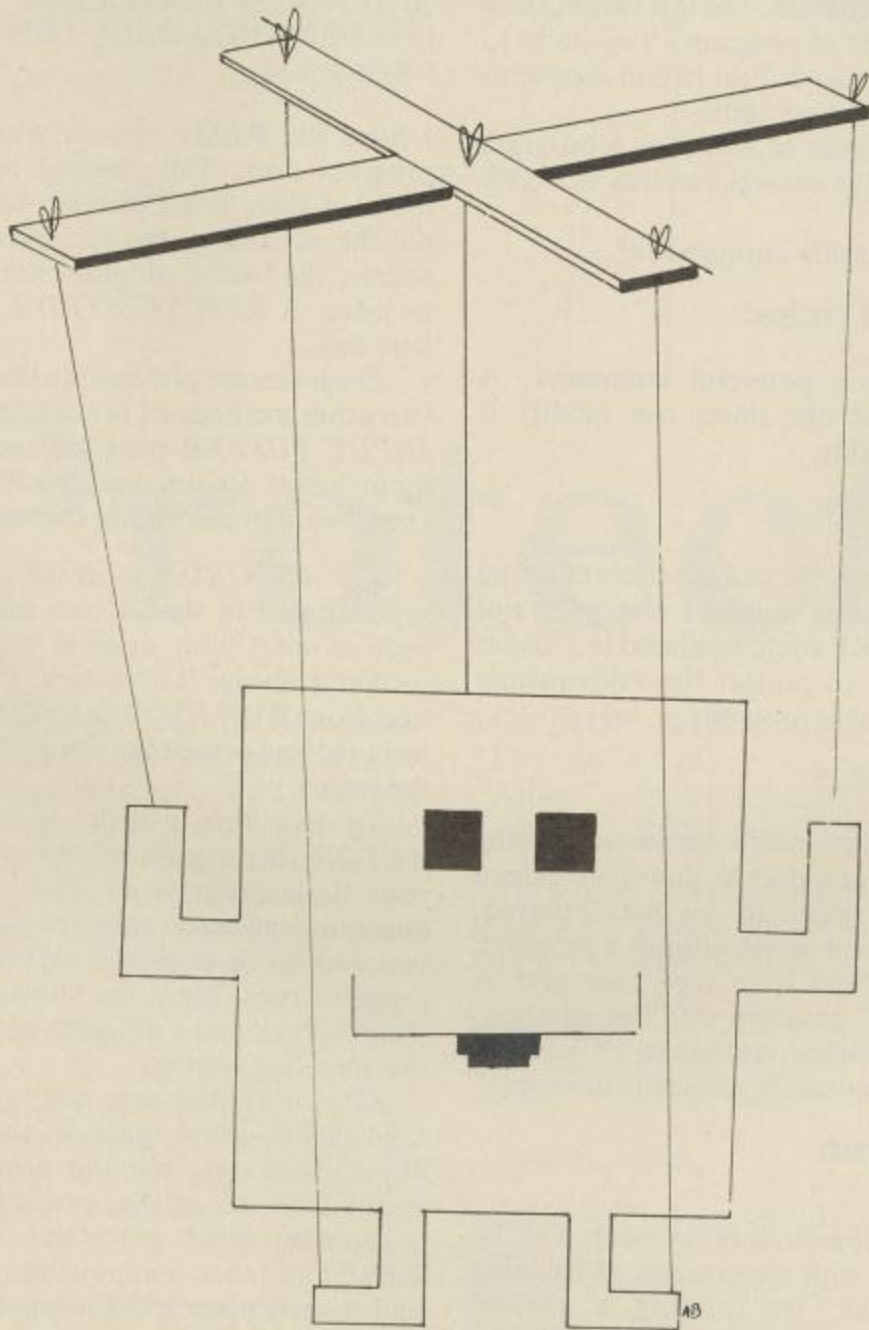
You can't damage the computer with software, so experiment. I would warn you to keep backup copies, as some of the methods could result in the loss of the program. Remember to save your program with the protection before running, as there is usually no way to get out of it!



*Sprite manipulation for Basic programmers can sometimes be a real chore - but not any longer.*

*By Alan Obee*

# SPRITE



# CONTROLLER

**Y**ou probably have a sprite designer such as *Your Commodore's 3 in 1 Editor*. With which you designed some aliens or fancy letters for a title screen that will never exist. One reason why this will never exist, may be because you don't know how to program the sprites to appear on the screen, or maybe you just can't be bothered to set up all those sprites, colours and X and Y co-ordinates exactly how you want them. Sprite Controller can solve both of these problems.

Sprite Controller allows you to place up to eight sprites on your C64 screen. Your sprites can be displayed in any way you wish; hi-res, multi-colour, X expanded, Y expanded, whatever is necessary. Then a stand-alone machine code program can be created and executed with a SYS call which will run the compiled file. All of this is done without the need to know or even understand machine code.

## Using the program

Type in `SPRITE PROGRAMMER CODE` and save it temporarily just in case anything goes wrong when you try to run it. If all goes well, running the program will result in a file called `S.PROGRAMMER` being saved to tape or disk.

Next, type `NEW` then enter and save `SPRITE PROGRAMMER` which is a normal Basic program.

The finished program is very easy to use. It can be used by an experienced programmer who doesn't wish to play around with the tedious task of manipulating sprites and trying to get the exact screen positions, or by a beginner because of the simple method in which data is entered.

The way in which a series of sprites is set up is by using switches - 1 for on and 0 off. To make it easier, let's go through the process of setting up two sprites.

First load Sprite Programmer and



run it. The machine code then loads in and the title screen appears. Pressing a key takes you to Page 1.

This screen has three boxes; ENABLE X-EXPAND Y-EXPAND.

These categories are all fairly self-explanatory.

To set up two sprites, let's use sprites 0 and 7 which must first be enabled, so press E for enable. A prompt will appear, at the top right of the screen, asking for 0-7. What it's asking for is the sprite we wish to enable, in this case we first want to enable sprite 0. Press 0, a 1 appears under sprite number 0 in the enable box. Repeat the process for sprite 7.

This operation works as a toggle, so to turn sprite 7 off, just repeat the process.

Once sprites 0 and 7 have been enabled you can expand them. I'll leave the X and Y expansion for you to play around with, it uses a similar method to enable.

Pressing F1 will take you to Page 2. The three boxes here are *Multi-colour*, *Use* and *Colour*. To make sprite 7 multicolour, press M and then 7. The box now tells us that sprite 7 is multicolour (set to 1), and the others are hi-res (set to 0).

The *Use* box shows which sprite is under control when placing sprites on the screen.

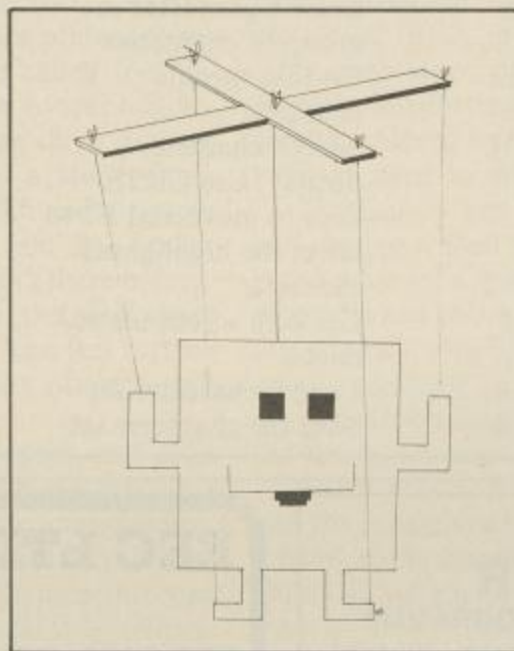
The *Colour* box works slightly differently to the others. Press C and the familiar prompt will appear: 0-7. To set sprite 0's colour to white, press 0 and another prompt will appear: 0-15. As you may have guessed, it's asking for one of the sixteen colours available to you on your C64. We want our sprite to be white, so look up the colour code for white in the manual and enter the value (which happens to be 1).

The colour box will now show a 1 under sprite 0, telling us it is set to white. Try and set sprite 7's colour.

Pressing F1 again will take you to the last page. Here you are presented with eight boxes. In boxes 0 and 7 there should be sprites of some description because these were the ones we enabled, but not necessarily the ones you want!

Beneath the boxes are some numbers, these are the sprites' data pointers. When you designed your sprites, they were placed in a certain part of memory and these data pointers can be used to tell the computer where, in memory, to get your sprites.

Sprite Controller allows you to use blocks 160-255 (\$A0-\$FF hex). If you use the 3 in 1 Editor, the blocks are shown at the corner of the grid. Let's say you have designed your two sprites in blocks \$A1 and \$A3, first convert this to decimal, so \$A1 is 161 (10 x 16 + 1) and \$A3 becomes 163 in decimal. Now we have to give the program these new values, so press B and enter the sprite number you wish to alter, for sprite 0 this is key 0. A prompt will then appear ready for you to enter your new value, key in 161. We have now given sprite 0 its new data pointer of 161. Now change sprite 7's data pointer to 163.



## Placing sprites on screen

We are now ready to place the two sprites on the screen. Remember on Page 2 the *Use* command? At present it should be 0, meaning that will be positioning sprite 0 on the screen. Usually you would have to switch between Pages 2 and 3 when *Using* and *Placing* sprites but it is possible to use the *Use* command on Page 3 even though it's not shown.

After you have selected the sprite you wish to use press P on Page 3. The screen will clear and display all the sprites that are enabled, but you can only move the sprite that you have selected. The cursor keys will move your sprite around the screen. When you are happy with it's position, press RETURN.

Before entering this screen, the screen colours are stored so you may change the colours without altering the editor colours. Note that the colours on the position screen will appear on the compiled program.

## Extra options

Pressing F7 will take you into a menu of other options, which may be called up from any of the three pages. You should understand most of the commands but one or two need to be clarified.

When you use the Save Variables option, you are only saving the data you have entered up to date and it can be reloaded to be completed later. Be careful when loading sprites in because blocks lower than position 160 will result in the sprite programmer being over-written.

## Creating the code

After you have entered in all of the data and placed the sprites in their correct positions, you are then ready to compile your program. I recommend that you save your data first because the compiled file cannot be edited. On Page 3, press C and enter the decimal value for the start address. In other words, where in memory you wish your code to be produced. The default location is 49152 (\$C000).

When compilation has finished the start and end address are displayed. If you wish to have more than one compiled program in memory at a time, then I advise you to jot down the end address of each part so you know where to enter the new code after the previous one.

You will now be asked for a device number (RETURN = disk) and a filename for your code to be saved under. A SYS number will be given after you have saved your code, make a note of it.

When you load your created file, the SYS number can be used in your program to activate the routine. Machine code programmers can convert the SYS number into hex and use a JSR or JMP command, e.g. JSR \$C000 or JMP \$C000.

## Better late than never

I made a late addition to the program so it is now possible to display a background screen to help when placing your sprites. By pressing F8, a screen can be loaded at location 32768 (\$8000). I thought this useful for situations when sprite positioning needs pixel accuracy, such as for start positions in games.

Have fun.



# Graphic Editor

*makes short work of  
designing small graphic  
blocks of characters*

A large character editor is frequently more of a nuisance than a help, especially when a new alphabet or a small graphic block is the only requirement. This graphic editor can cope quite happily and then it will save the data as a data block for immediate loading, or as a Basic program that is ready to be poked into memory.

The program copies the character ROM into the area from \$8800 to \$9000 (34816 to 36864). As a RAM image they can then be individually altered using the range of 20 commands. The editor does more than this, up to 120 characters can be arranged in a 15x8 block for creating larger graphics on screen.

## Commands

B	Copy upper or lower case characters from ROM	M	Multicolour toggle
C	Copy one character to another position in the text	P	Scroll a character to North, South, East or West
D	Store character set on tape or cassette as Basic DATA	R	Rotate current character through 360 degrees in 90 degree jumps.
E	Erase a character or group of characters	W	Select right or left window for action
G	Go to a specific character	+	Next character
H	Search character display. Use CRSR keys to move and F7 to select the highlighted character	-	Previous character
I	Get help screen instructions	CRSR	Move cursor around editing screens
L	Load a character set	DEL	Erase last pixel to left of cursor
S	Save the character set	SPACE	Erase highlighted pixel
		F7	Turn pixel on
		CTRL/RVS	Reverse pixel states
		RUN/STOP	Abort current command
		X	Exit



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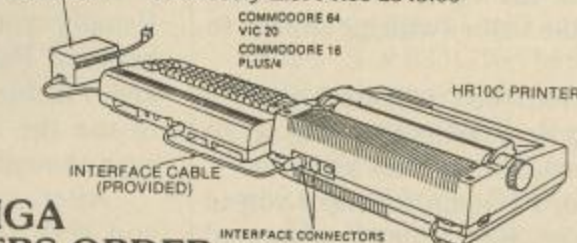
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# ULTIMA IV

**A**t last! The Amiga version of one of the classic role-playing games has been released by Origin Systems. Although the fourth game in the series, Ultima IV is a quantum leap forward from its three predecessors.

Once the destruction of Exodus had been completed, as told in Ultima III, there were many upheavals, both geographic and political. New mountains rose whilst others sank without trace. A large continent fused together and it was upon this land mass, Britannia, that Lord British managed to bring some semblance of normality. As the Dark Age moves towards a new Light Age, the philosophers decide that a new set of moral values are called for. So it is that the quest for the Eight Virtues of the Avatar begins.

While taking a walk in the country one day, you are surprised to see a strange light appear in a stone circle near by. Further investigation reveals an ankh and a couple of books. As you continue your journey, you feel drawn to a mediaeval fair that you could swear wasn't there before. Instead of demanding your entrance money, the gatekeeper sees your ankh and welcomes you heartily. You feel further drawn to a gipsy caravan where an old lady offers to tell your fortune.

In front of you, she places a pair of cards and asks you to choose between them. The cards represent questions based on the eight virtues – honour, valour, compassion, honesty, humility, justice, sacrifice and spirituality. There are no correct answers. For example, the King sends you on a delicate diplomatic mission. In the banquet that follows, your country is terribly insulted. Do you bite your tongue in order to try and save the talks or do you stand up and defend your country to the best of your ability?

Once your career has been determined in this way, you are transported near to one of the eight cities of Britannia – each one specialising in one of the virtues and races of characters. At the start of the game, you are on your own. You will have to persuade seven other characters to join your party. Some will do so willingly, others will only join when you have reached a certain level of experience.

The initial quest involves building up your character so that he, or she, attains partial Avatarhood in each of the eight virtues. This is not as easy as it sounds because you will need to discover the appropriate shrine to meditate in, know the correct mantra and have found the appropriate stone. You must also have proved that you have reached sufficient proficiency in that virtue.

Information about various objects is gleaned by talking to everybody that you meet. Initial enquiries can be made as to a person's name, job or state of health. From the answers given, you get a clue to the next keyword about which to ask. Frequently you are cross-referred to someone else on the other side of the continent – ask at the Folley Tavern about Mandrake and you'll see what I mean.

This direct communication, although very limited does the give the game a definite, realistic edge over its rivals and is a start to introducing a system of non-player characters as found in traditional role playing games.

Transport is usually by foot but there are several other



methods of moving about more quickly. Horses can prove useful but you are likely to make more use of the moon-gates. Britannia has two moons and, depending on the phases of these, moon gates appear at certain locations. Each gate stays open for three segments of time, each segment teleporting you to a separate location. Sea travel can be achieved by hijacking yourself a pirate ship although you will need to master the art of using the winds.

Fighting is not just a case of using the right weapon and casting a spell or two. Instead, every combat situation is fought over a mini playing area in which characters and monsters can move, as well as attack. As the monsters can attack along diagonals and you can't, you will need to give serious thought to your tactics. Making the best use of any missile-casting members of your party could well be the key to success.

Spells play a vital part in any fantasy role-playing game and the magic systems in Ultima IV is one of the best that I have come across. Several professions have a magical ability although, obviously, it is the mages who will be doing most of the spell casting. Characters have a number of spell points and can cast spells according to this ability. Providing, that is, that a suitable spell has been previously prepared.

Graphically, Ultima IV doesn't look anywhere near as pretty as its rivals, Bard's Tale for example, but, as they say, the play's the thing and here Ultima scores very heavily. The storyline is coherent and, what is more, credible. Nowhere will you find snakes with legs (Phantasie III) or monsters ninety feet away in a ten by ten room (Bard's Tale).

For anyone who has seen the C64 version of Ultima IV, the conversion will come as something of a slight disappointment. The two versions are more or less identical. Not surprisingly, the graphics are better on the sixteen-bit machine but not devastatingly so. One area where things could have been improved is in the system of command entry where use of the keyboard is still necessary. I felt that a series of pull-down menus could usefully have been implemented.

That apart though, Ultima IV is a superb game offering between one and two hundred hours playing time. You should just have time to get close to completing it before the long awaited Ultima V appears. Very highly recommended.

**Gordon Hamlett**

#### Touchline:

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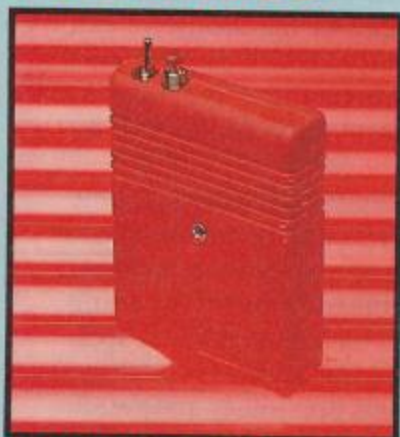
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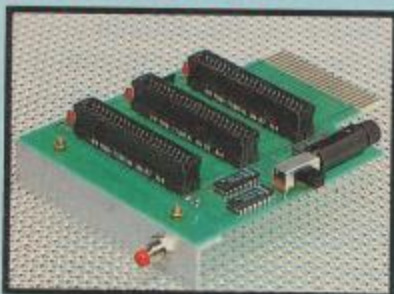
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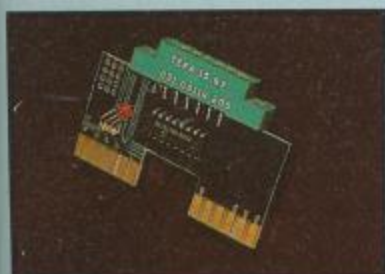
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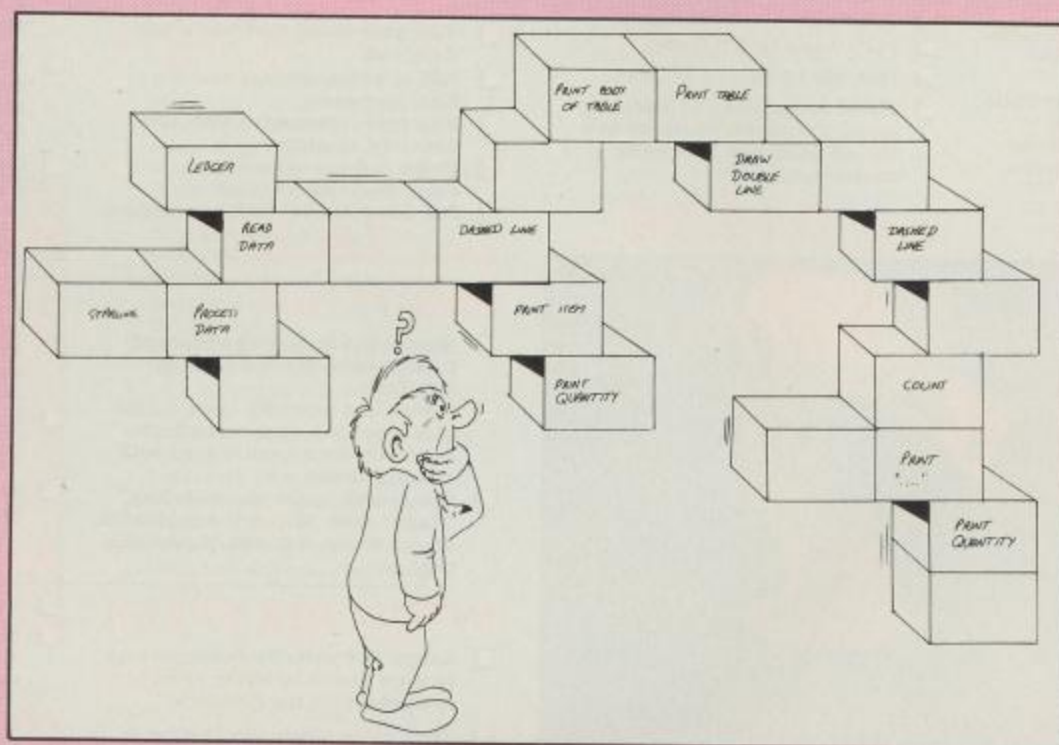
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# STRUCTURED PROGRAM *Design*



*The follow-up article to improving the standard of your programs with structured programming*

**By Derek Barrett**

**F**ollowing on from last time we'll continue to look at the third element — repetition.

Figure 7 shows the simple construction of a fixed loop. Box A leads us into the routine and serves as a comment. B shows that it is a repetition box and the figure 100 determines the number of times that the actions of C,D and E will be carried out. The variable name for the counter is usually written in the box.

What happens here is that actions C,D and E will be repeated, as a sequence, 100 times. This fragment of code should show the idea:

```
90 REM Process Number
100 FOR count = 1 TO 100
110 GET number
120 PRINT number
130 total = total + number
140 NEXT count
150 REM remainder of program
```





WHILE and REPEAT constructions are similar with the conditions included in the repetition box. (Figure 8).

This construction does not have a fixed number of repetitions so no number is included in the box. The controlling element in this case is that the variable TOTAL is less than 500. Hence the action will be carried out at least once and repeated until TOTAL exceeds 500. Those of you who do not have WHILE or REPEAT constructions in your language will have to re-arrange your code slightly to achieve the same result.

This is one occasion where GOTO will have to be used. Look at the following fragment of code:

```
90 REM Process Number
100 GET number
110 PRINT number
120 total = total + number
130 IF total < 500 THEN GOTO 100
140 REM Remainder of program
```

This will simulate a WHILE condition and as the GOTO only jumps a few lines the program is still readable. As you cannot show a jump in Top Down design you should draw your designs as Figure 8 so that it remains portable.

As I showed in the examples on selection, multiple conditions can also determine the repetition construction (Figure 9). Complex conditions can be shown alongside the box to avoid trying to cram too much into a small space.

## Reading Ahead

A common application of the top down technique is the reading of an undefined number of data items. Such a list usually has an 'End of File' (EOF) marker (often -1 or -999) which must be detected to terminate the loop. To design this you can use a WHILE loop with the condition 'NOT END OF FILE'. This means that we must already have read an item of data before entry and must read again as the last box before re-testing the condition. This is commonly known as the READ AHEAD technique. (Figure 10).

This construction is a common trap for the beginner. Make sure that you understand it and test it thoroughly.

Find out for yourself what would happen for the following:

- B was omitted.
- E and F were reversed.
- After several numbers have been read in an EOF marker is read.
- The first item read is an EOF marker.

## Procedures

When designing your latest masterpiece you will often find that the same part of the design crops up in several places. Why not group them together, as sub-routines or procedures, saving space in the final code and aiding legibility? In fact most

professional programs consist almost entirely of procedures, with the main part of the program being simply a list of calls to the procedures. This greatly aids legibility and also allows easier modification of the final program. All you have to do is write a new procedure and call it when needed.

Unfortunately Commodore BASIC does not support PROCEDURES but does have GOSUBs which, although not as versatile, can be used for a similar function.

Procedures are shown on top down designs by a horizontal dividing line a short way down the box. The procedure name is written in the box. When a procedure is called from the main design no further subordinate (lower) boxes are drawn from it. The procedure itself is shown on another sheet with the procedure box at the top. It may help in very large designs to show the page number of the procedure in the box as well.

Figure 11 shows an example. B calls the procedure DASHED-LINE which is on page 2 of the design. The result of running this will be to jump from B to the procedure, which draws a line of dashes across the page, then return to C, where 20 items and their quantities are printed. D calls DASHED-LINE twice, to put a double line of dashes across the page.

## Putting It On Paper

The designs you produce will use up

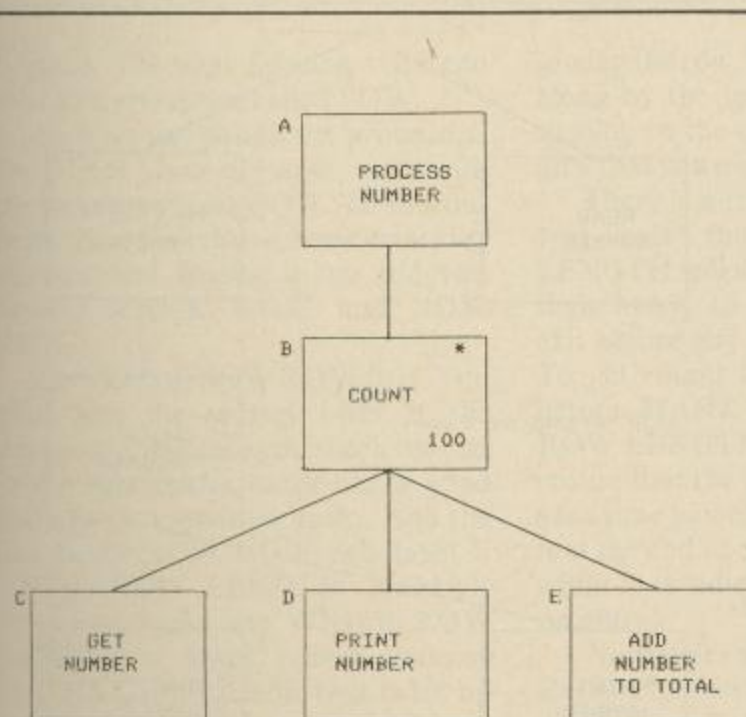


Figure 7 - simple fixed loop

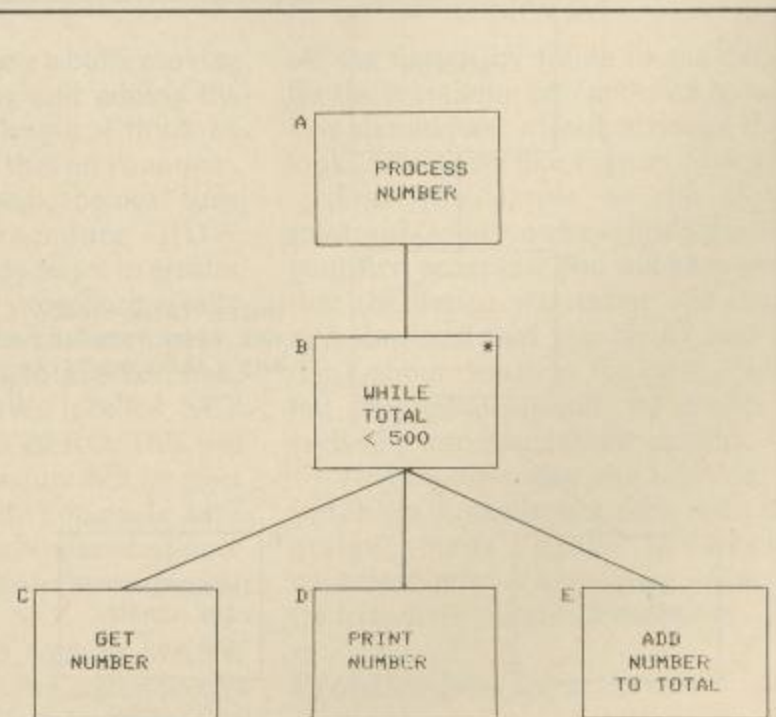


Figure 8 - repetition using WHILE condition



lots of paper. I tend to sketch mine out on A3 sheets before walking through them, modifying where needed, and then producing a final form, with a flowchart stencil, before I start to code them. Very often the designs grow so much that a single sheet of paper is not enough and some way of linking several sheets is needed. I will now introduce the only other symbol that you will need. It is a circle with the page number in it as shown in Figure 12. 12a shows a link to page 2 and 12b shows the opposite link from page 1. Such advanced ideas are taxing on the brain aren't they? What will I come up with next?

## Conventions

We have now covered all of the constructions that are needed for even the most complex of designs.

Before we go on to look at some practical examples there are a few conventions to top down design that I will get out of the way. Most of these will be apparent from the designs and some have already been mentioned.

There can only ever be one path from an elementary box back to the top of the structure.

The design reads from left to right and from top to bottom.

Subordinates of a box must be:

- all sequence boxes or
- all selection boxes or
- one repetition.

Only one path of a selection applies.

## Problem Solving

Now that you understand the constructions needed in Top Down Design we can have a look at a practical problem and go through its design.

The first example is, at first sight, very simple but will show the principle involved and also shows how Top Down Design can be applied to problems other than programming.

## Playing In The Garden

Imagine that you are a keen gardener and you want to plan your bulb sowing into orderly rows.

You have decided that each bed must be prepared, planted with bulbs and finally watered.

This is easy. Start by putting a single box at the top centre of the page and title it Process Garden. Then put a sequence of three boxes below,

leaving a reasonable gap between each as we will expand downwards later. Label these boxes Prepare Bed, Plant Bed and Water Bed respectively.

You should now have something like Figure 13. That has solved the problem but let us expand it a little. Suppose now you decide that the bed should consist of:

- One row of Begonias, spaced 25cm apart.
- One row of Gladioli, spaced 50cm apart.
- One row of Dahlias, spaced 20cm apart.

Here we must use repetition to determine the row. So add a repetition box below PLANT BED, label it ROW and indicate that it will be repeated 3 times. Now we must use selection to select the correct type of bulb. Add three selection boxes below the repetition box. Label these IF ROW = 1, 2 or 3 respectively.

As the action of planting the bulbs will be the same in each case we can use a procedure. But first we must set up the parameters that we will pass to it. That is, the type of bulb and its spacing.

Add three boxes below the first selection box. Label the first Bulb =

Figure 9 - repetition with complex WHILE condition

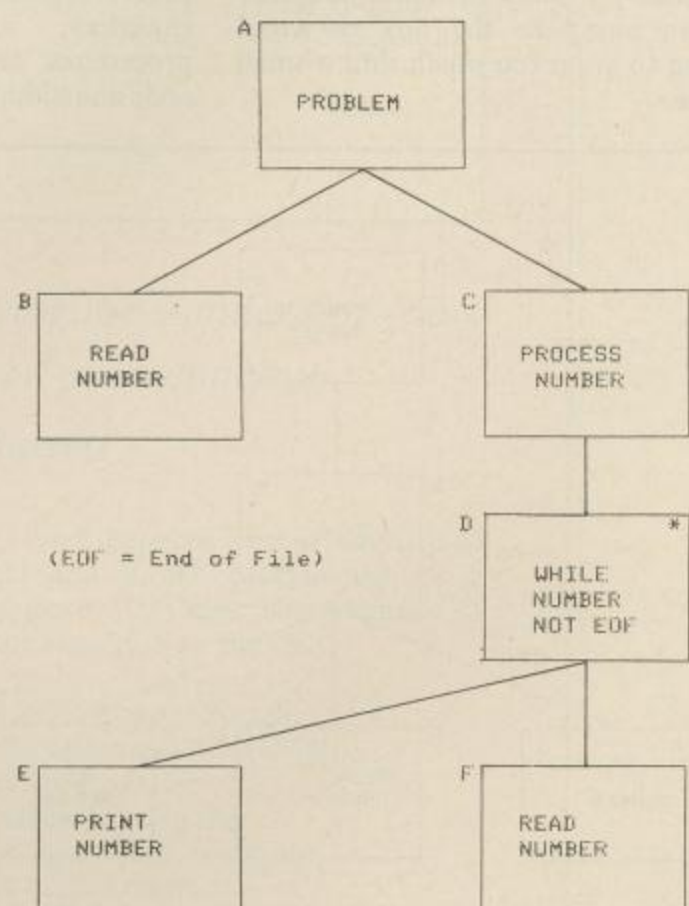
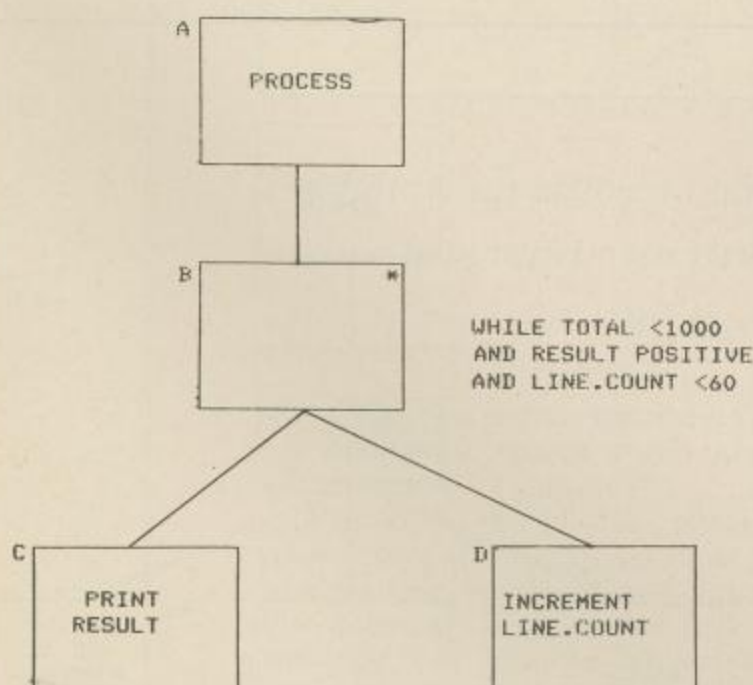


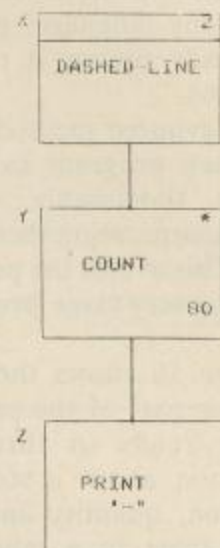
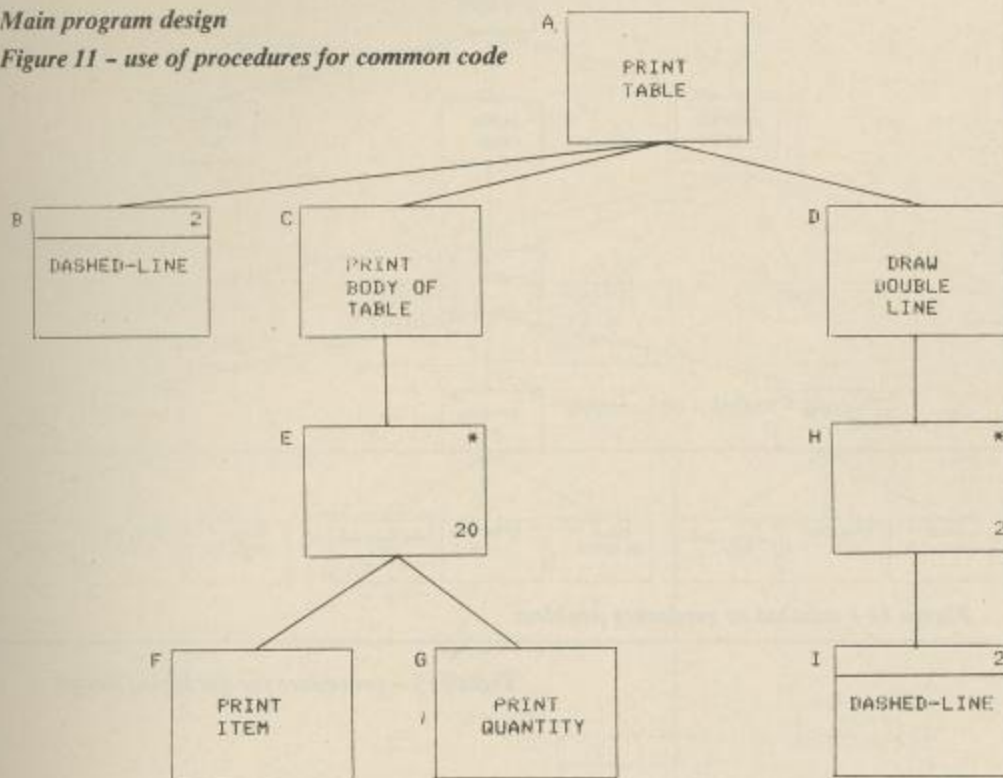
Figure 10 - read ahead technique





## Main program design

Figure 11 - use of procedures for common code



Procedures on page 2

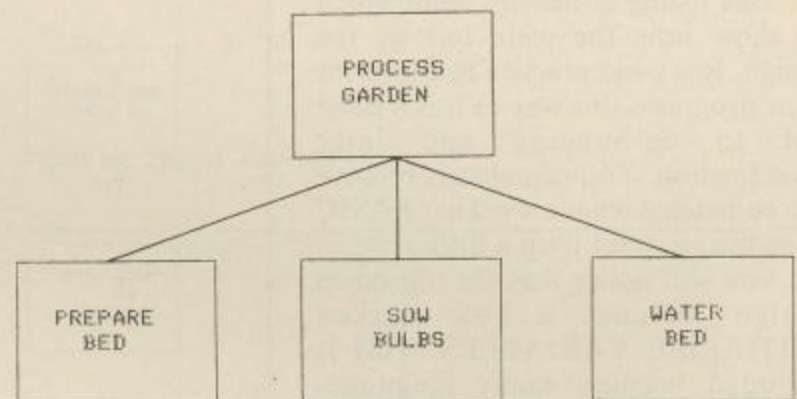
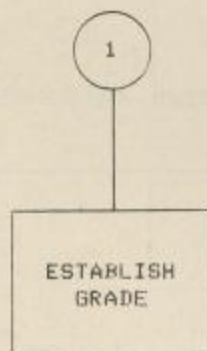
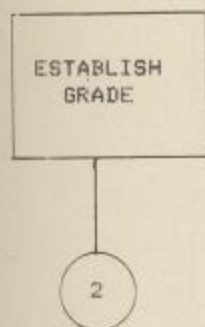


Figure 12 - links between pages of design

Figure 13 - first step to design for sewing bulbs

Begonia. The next Spacing = 25 and the last a procedure called SOW.

Now we can design the procedure. On a fresh sheet of paper, start with the procedure block SOW. To sow our bulbs there are two actions, marking the row and sowing it, so add two boxes, MARK ROW and SOW ROW.

Let's look at SOW ROW first. You must sow the correct bulb at the correct spacing until you reach the end of the row so this looks like a good place to use repetition again. Add the box below SOW ROW and label it UNTIL ROW LENGTH > MAX (You could also use WHILE ROW LENGTH < Max). I have assumed that MAX is a variable that is set up elsewhere but could be replaced by a figure if the row length is known.

The use of a variable allows for easier modification later if desired.

There are now three actions to

sowing the row, sowing a bulb, moving along by the spacing and adding the spacing to the row length. I think by now that you can do that on your own.

There is a trap here, the next time you call the procedure ROW LENGTH will already be set to greater than MAX so the procedure would exit before any bulbs had been sown. To get round this add another box, before MARK ROW, labelled SET ROW LENGTH TO ZERO. This will ensure that the procedure will be reset each time you enter it. You could have it at the end of the procedure but once again it is tidier if conditions are set on entry.

Now you can go back to MARK ROW. Here we need two action boxes. The first can be labelled something like MOVE LINE BY SPACING and the second DRAW ROW.

Having now designed the procedure you can go back and finish

off the design by filling in the detail for the remaining two selection boxes. You should have a finished design that looks something like Figures 14 & 15.

Did you arrive at the same solution? Good, you have just designed your first program. You will have seen that the design was taken one stage at a time and that you haven't had to think about details at the early stages but progressed logically by breaking each step into manageable chunks.

There is never just one solution to a problem. Sometimes a more complex design lends itself to easier modification at a later stage. Always try to look for alternate solutions.

## Problem No. Two

Let's take a look at another design. Some time ago I was working on a program for a sales ledger. This was written in Pascal on a mainframe





computer but I re-coded it into Commodore Basic to show that you can use any language. As the design was already proven it ran first time on my C64.

My favoured method is to design a complex program in fairly small modules, thoroughly testing each, before incorporating them into a final design. This avoids the problem of debugging a very large program in one go.

Figure 16 shows the Top Down design for part of the program. This segment reads in three items of information about a stock item (its description, quantity and price) and displays them in a table with total quantities and discount prices. Listing 1 is the source code in Pascal and Listing 2 is the same design in Commodore Basic. The only change that I made was to incorporate some test data at the end to avoid having to create a data file on disk first.

This listing is heavily commented to show how the code follows the design. It is good practice to comment your programs this way as it is a good aid to de-bugging and later modification. You can always remove the comments from a working BASIC program to speed it up a little.

You will notice that the top down design includes a box marked INITIALISE VARIABLES. This is included because many languages require that all variables, etc are defined before they are used.

There is another box, INITIALISE CONSTANTS. It is good programming practice to use constants wherever possible and to put these high up in the program, so that they can be easily modified if the need arises. Here they are used for the discounts given and so will probably change during the lifetime of the program.

The rest of the design should be easy to follow from what you have already learnt.

That's the lot then. If you make a conscious effort to use Top Down Design in all your future projects you will soon gain the experience to be able to design efficient, well structured programs that are a pleasure to code and much easier for others to follow. Who knows? Perhaps one day magazines will start to include Top Down Designs in their pages and allow the reader to program them in their favourite language. Don't just sit there, get designing your next, wordbeating, program.

YC

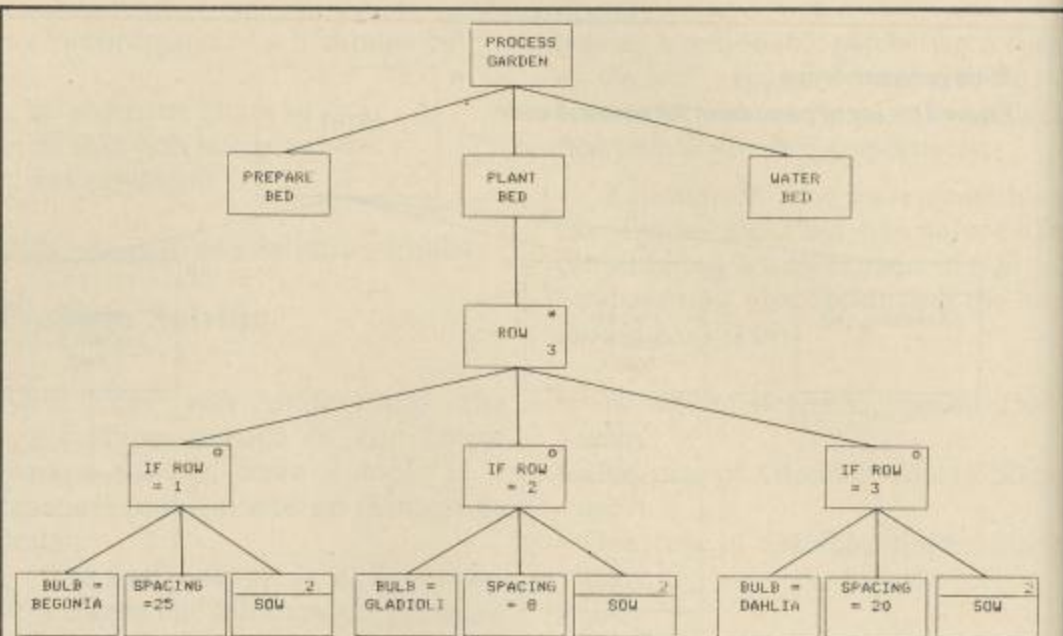


Figure 14 - solution to gardening problem

Figure 15 - procedure for gardening design

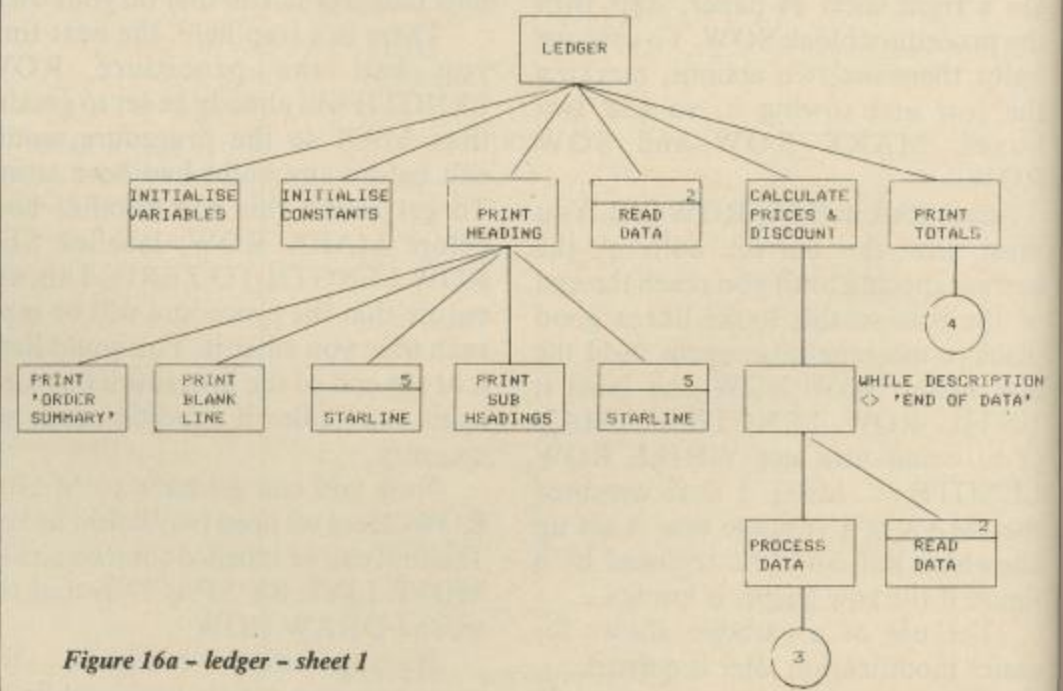
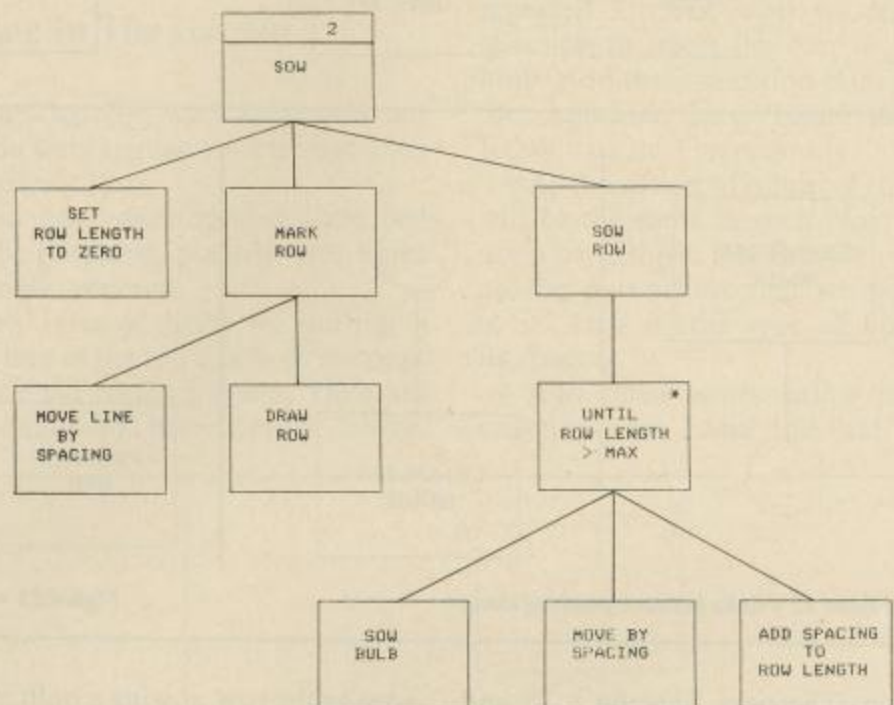


Figure 16a - ledger - sheet 1



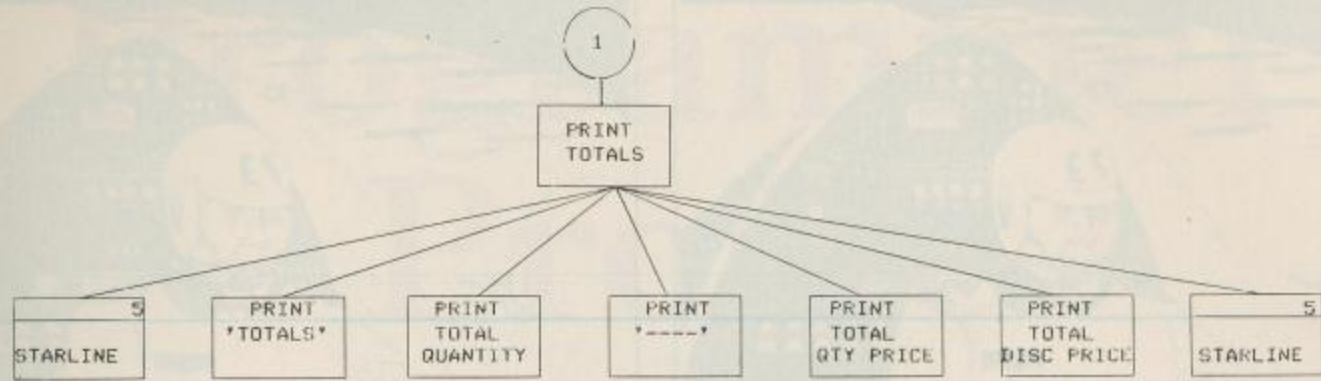


Figure 16d - ledger - sheet 3

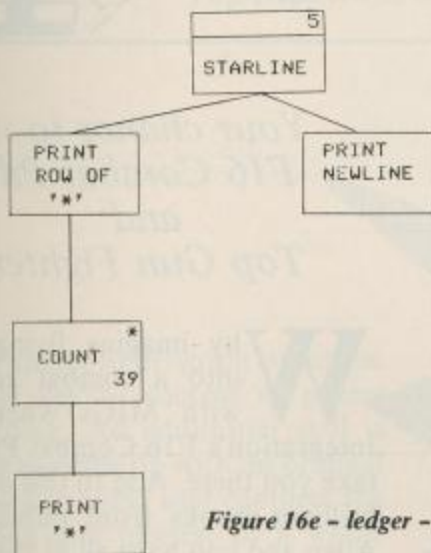


Figure 16e - ledger - sheet 4

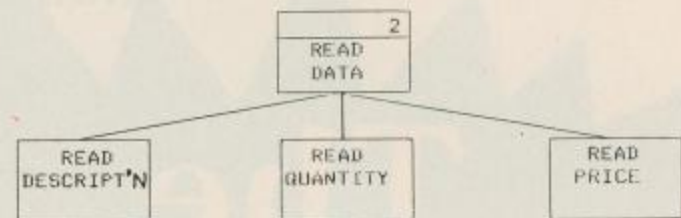


Figure 16f - ledger - sheet 5

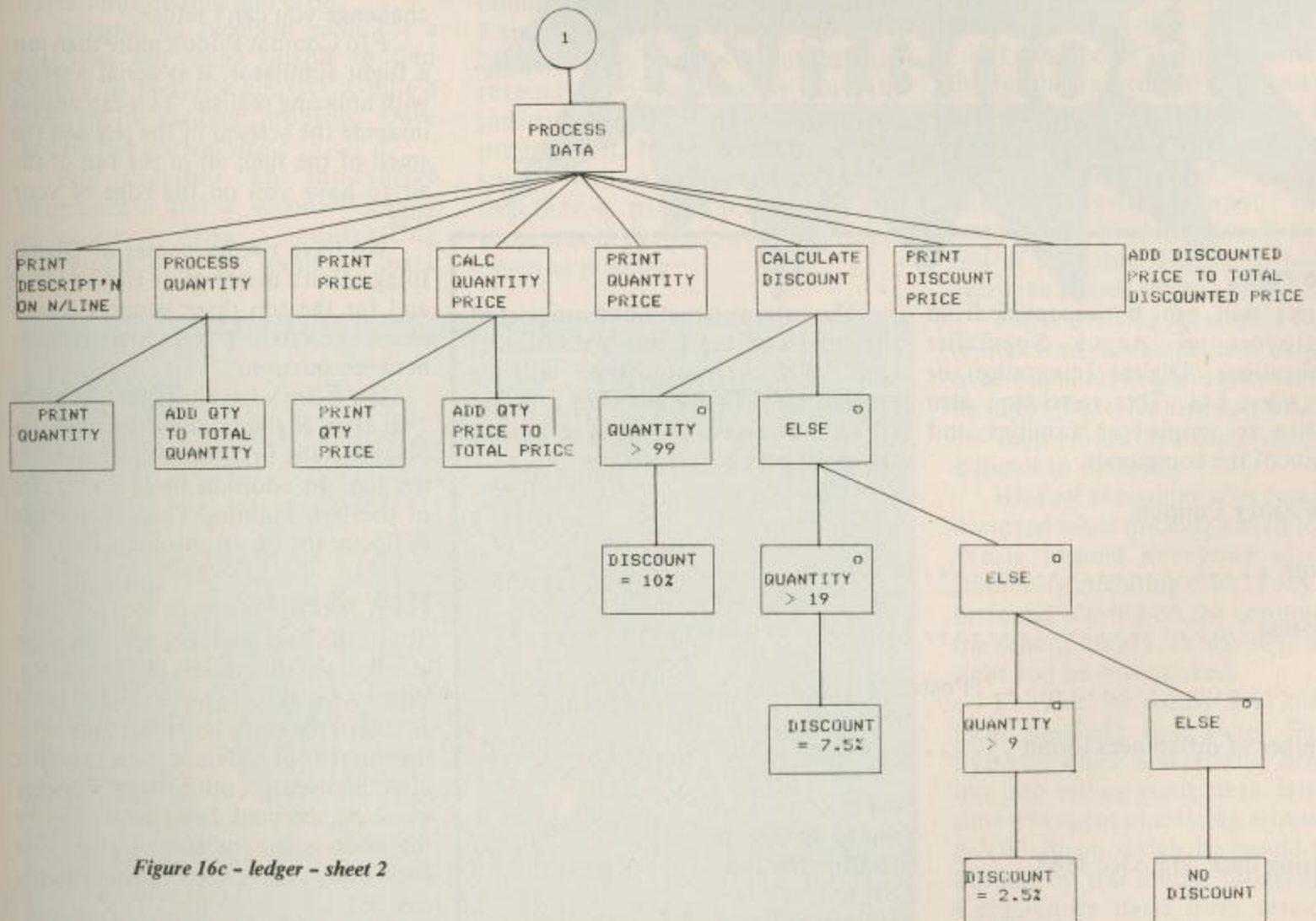


Figure 16c - ledger - sheet 2





# The Fantastic Combat Bonanza

*Your chance to win  
F16 Combat Pilot  
and  
Top Gun Fighters*

**W**hy imagine flying an F16 into a combat zone filled with MIGs when Digital Integration's F16 Combat Pilot could take you there. Add to this one of two brilliant books from publishers Ian Allen and you have all of the elements that makes this competition a challenge you can't refuse.

F16 Combat Pilot is more than just a flight simulator, it is aerial warfare with amazing realism. You can almost imagine the scream of the jets and the smell of the fuel; all of the fun of the air to have you on the edge of your seat.

We have twenty copies of Digital Integration's masterpiece to give away and for the top three winners there's also a book to help them to wind down between missions.

Ian Allen's have offered a copy of Top Gun Fighters and American Jet Power to the first winner picked from the hat. In addition there are copies of the F16 Fighting Falcon by Peter R Foster for the two runners up.

## How to enter

Study the two cartoons on this page and find the differences between them. When you think you've found them all, fill in the entry form and also write the number of differences on the back of your envelope, otherwise your entry won't be accepted. Send your entry to the address on the form by the 31st December and keep your fingers crossed.

## The rules

Entries will not be accepted from employees of Argus Specialist Publications, Digital Integration or Ian Allen Ltd. This restriction also applies to employees families and agents of the companies.

The entry instructions form part of the rules and the Editor's decision is final. No correspondence will be entered into. In the event of a postal strike, we reserve the right to extend the closing date.

## F16 Entry Coupon

Name .....

Address .....

.....Postcode .....

Number of differences found .....

Closing date: 31st Dec 1988

Post to:  
Your Commodore  
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London W1R 3AB



# Programmer Profile

*Individually, Tony Crowther and Dave Bishop have enviable reputations but now they have combined forces.*

*By Eric Doyle*

The ability to program is not the sole key to success in games writing. An additional skill is to be able to come up with an original game which in some way captures the imagination and interest of a whole range of people. Tony Crowther has learned this by trial and error.

Devising an excellent game for a computer but being unable to find anyone to precisely convert it into a program is another problem. Dave Bishop has learned this.

Put together an innovative programmer and a visionary games developer from contrasting backgrounds and the result can spark

as brightly as an arc lamp. The combination of Crowther and Bishop could set the software world alight.

## Ratt's Tale

Anyone who has watched scrolling messages on Compunet demos will be familiar with Tony Crowther's alias of Ratt. Alongside his friend, Yak (Jeff Minter), Tony must be one of the most respected programmers in the industry. A programmer's programmer, he is renowned for the speed with which he can cobble together a program, yet he still programs in decimal, avoiding hex as much as possible.

At school, Tony was never very good with figures, in fact, he was not very interested in academic subjects generally but he could relate to anything with a practical application. Not surprisingly, his main interest at A level was Technical Drawing though he supported the course more in spirit than in the flesh during his first year.

"I can't resist a challenge so when the teacher asked me if I wanted to pass or not I started to take things more seriously. Halfway through the final year I was turning in good work and the course turned into a competition between myself and the rest of the class. The result was that everyone passed the exam that year!"

The underlying message in this tale is that Ratt is competitive and hates to be beaten. If he takes on a challenge, he likes to excel which can make him an inspiration to work with but difficult to control.

His first encounter with computers occurred while ducking out of lessons. While almost everyone else was studiously attending class, Tony could be found playing on the computers in the school library. It was love at first sight and he was hooked.

For fun, he would help out at a local Sheffield hi-fi shop, Superior Systems, which had recently branched out into selling computers. His spare time was spent in messing around with a VIC 20 on which he would amuse himself by translating programs into Commodore Basic from versions he saw on other machines.



Trap



Although his own version of an adventure like *Golden Arrow* was an exciting project at that time, the lack of speed lured him to try his hand at machine code. Armed with a crude monitor and a copy of Nick Hampshire's *VIC Revealed* it wasn't long before someone at Superior Systems started to take notice of the demos he was producing and a long, but not uneventful, relationship with Alligata Software was born.

Tony openly admits that his ultimate aim is to achieve fame and glory. He would love to have created Pacman or to have been in Geoff Crammond's shoes as the originator of *Sentinel*. Consequently, one criticism of the younger Tony was that he would guard his projects jealously and refuse outside 'interference' no matter how well meant it may have been.

Eventually, he felt that staying with Alligata was not in his best interests, switched to Gremlin for a while and then found total freedom with Wizard Developments. *William Wobbler* was his final project with the company and, technically, one of his greatest achievements but the sales were disappointing and with the demise of the company he returned to Alligata but on a better footing than before.

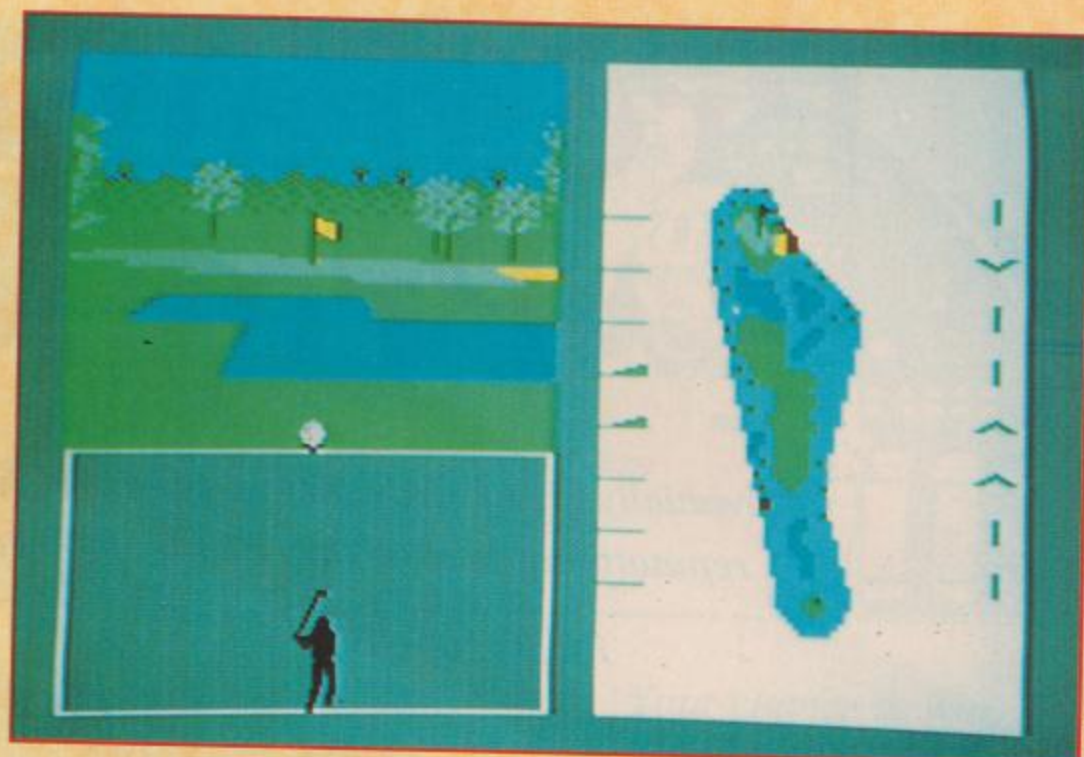
Unfortunately, Alligata's moon was starting to wane and despite great critical acclaim for Ratt's *Trap* and a large advertising campaign, the game flopped badly and the follow-up *Kettle* went much the same way.

About this time, Ariolasoft released Electronic Arts' *Marble Madness* which Tony saw as a good idea gone bad. Two weeks later, armed with his own demo version of the game, he approached Ariolasoft with all the cheek of Yosser in the TV series *Boys from the Black Stuff*. It's almost possible to visualise Tony, slapping the Crowtherised *Marble Madness* into the nearest disk drive, saying, "I could do that. Gi'us a job."

The team at Ariolasoft were impressed but couldn't release the game because they didn't hold the external rights to the game. They did, however, give him a job.

Once more Tony's ambitions were curtailed by Ariolasoft hitting hard times. Electronic Arts decided to control their own operations in this country and Ariolasoft's other mainstay, Broderbund, had already deserted to the US Gold banner.

This was the long and torturous



Golf Construction Set

path which led Tony to Mirrorsoft's door, and his teaming up with Dave Bishop.

### The Bishop's Tale

Dave Bishop has been involved with computers for several years but he has never been interested in programming. For him, the thrill is to devise the games he'd like to see and leave the rest to programming specialists like Tony.

On leaving Aston University with a Degree in Marketing, he worked for a while as buyer for the Games Centre chain before setting himself up as a distributor for Vulcan chess computers. During this period, Dave also imported the first Spectravideo Quickshot joysticks and their success pulled him firmly into the world of computer games.

During a spell as the software developer for Hungarian software house, Andromeda, he forged close links with Ariolasoft. When he later launched his own public relations and game design company, Tigress Marketing, Ariolasoft snapped up programs like *Deactivators*, *They Stole A Million* and *The Golf Construction Set*. Strangely enough, this was happening at the same time as Tony was working with the company.

In mid-1986 Bish cut loose and became a freelance games designer working for companies like Magnetic Scrolls and Real Time (British Telecom's main suppliers and program developers), Mirrorsoft and Psygnosis.

When Ratt and Bish were teamed up for Mirrorsoft's new Image Works label, they formed an immediate



Chinese Juggler



mutual appreciation society.

"Tony's really great to work with. He's got it sussed and knows what he's doing. He'll try anything. When I showed him the design for Zig Zag, he said it was impossible so I shelved the idea. A week later I had received his demo and it was up and running!"

"Bish seems to pull his ideas out of thin air. Just before Christmas, he was visiting our house. I went to bed and the following morning I found that he'd woken up at about four o'clock with the idea for Bombuzal. By breakfast time the gameplay had been sorted out and the game was ready for me to start work on. By Christmas, the first demo of the game was ready for approval as a special present for Image Works."

The Bombuzal project was shelved for a while in favour of Fernandez Must Die but that didn't stop work on the game. As a result, Bombuzal is ready for launch within weeks of the critically acclaimed Fernandez.

### Hopes and Fears

Tony realises that the Commodore 64 can't go on forever but, even for such a seasoned programmer, the thought of tackling the Amiga hangs over him like a dark shadow.

"I wish I was like Ross, he can turn his hand to anything. Show him a machine with a microprocessor and he'll master it."

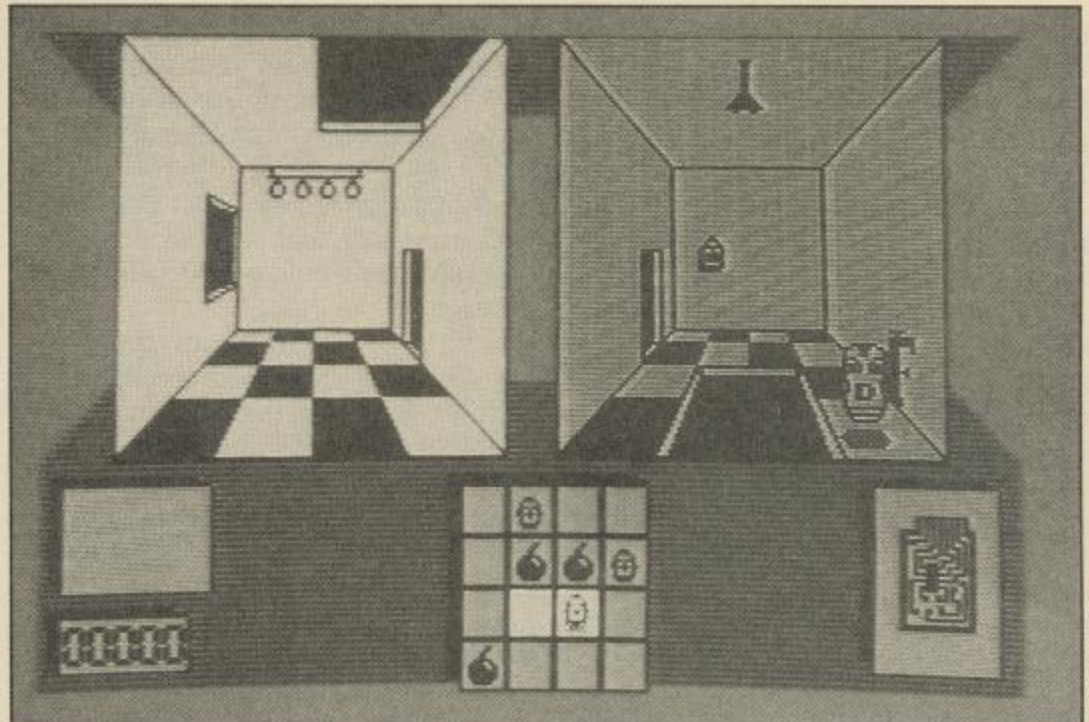
Ross Goodley, friend and long-time associate, has been with Tony from the Alligata days of yore, through Ariolasoft and is now working on the ST version of Bombuzal for Image Works. Unlike Ross, Tony feels that he needs to study a computer for some time and he's now very excited about his first pure Amiga project, Phobia.

"I wanted to quietly try programming something on the Amiga so I worked out the gameplay for Phobia myself. When I started to feel that it would work, Bish moved in and developed the gameplay further."

"I always want my games to be perfect and often I get an idea which means a totally new approach and programming starts again from scratch. This happened with Phobia, in fact it always happens, I just can't help it."

One thing Tony can't stand is the current trend of porting ST games across to the Amiga.

"Anyone who thinks that the ST is as good as the Amiga has got things totally wrong. The potential of the



Bombuzal

Amiga to produce arcade quality sound and graphics is being underrated. Barring Zenon, all the games I've seen so far look tacky. It would be better if games were developed on the Amiga and then modified for the ST."

One of the many things that Tony and Dave have in common is their unconventional lifestyle.

"I must be getting older. I used to have all of my computers set up on the floor and I'd program them while lying on a large bean bag. At the PC Show I bought a large computer desk and chair."

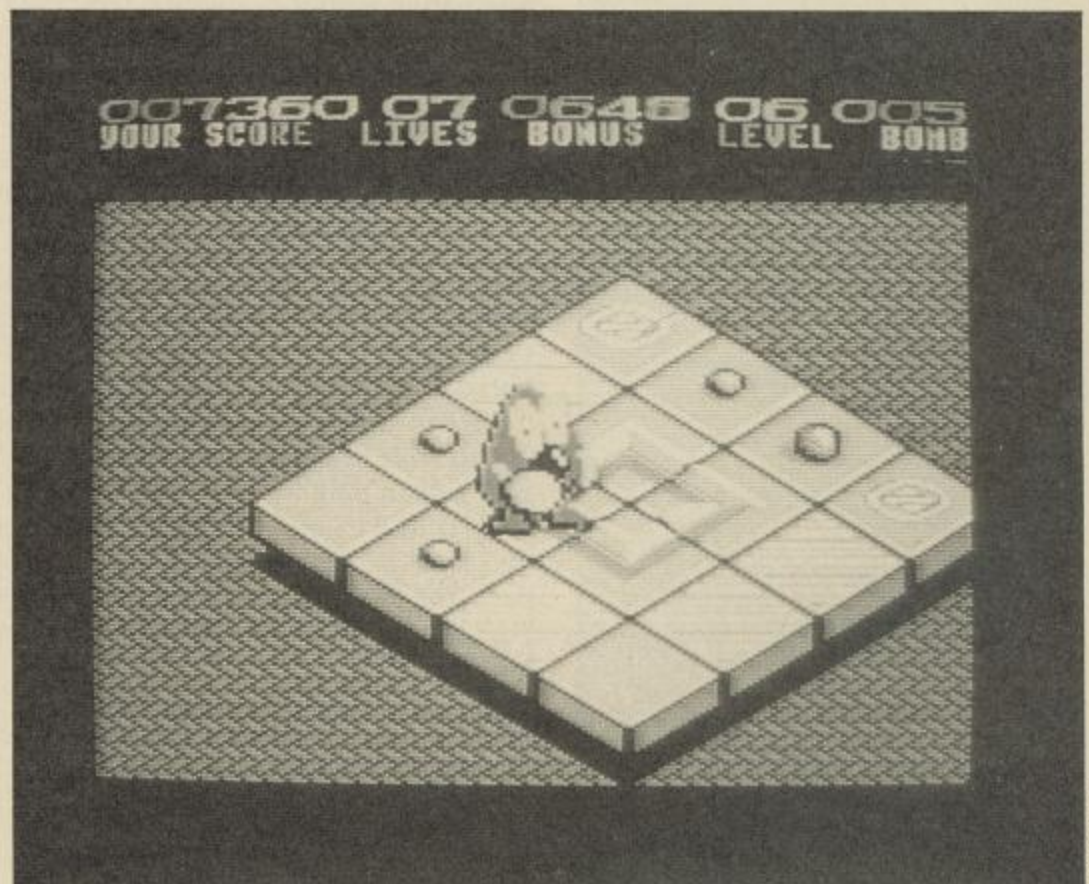
A typical day for Tony starts at

3 o'clock in the afternoon. He'll then program through till about six, the following morning. He then spends a couple of hours watching videos of the TV programmes he may have missed while he was working. These are recorded by his extremely understanding and patient wife, Lisa.

### Plans and Schemes

Dave Bishop's life is slightly more conventional, unless an idea hits him.

"Some of my ideas are sparked off by seeing a game and thinking how it could be made better but occasionally I'll be inspired by a



Bombuzal



dream. My dream games are extremely vivid and I can recall them quite well when I wake up so I have to grab a pen and write down the details before I forget, no matter what time it is."

Years of experience has given Dave a definite idea of how game designs should be marketed.

"First of all, a new game plan should be original and not just a straight copy of something that already exists. The next stage is to find a publisher or development group to take on your idea. Even if you can program the game yourself, marketing is an expensive business to do well, so you're best advised to get a non-disclosure agreement drawn up by a solicitor and get it signed by the

company you approach before you tell them anything about your game.

"There's more money to be made if you approach a publisher direct, especially if you're a programmer as well, but if your game isn't extremely well presented and worked out your best recourse would be a development group.

"Try to impress anyone you approach by being as professional as possible. Research the company, make sure they would be interested in your type of game and work out what you want to say before you meet them.

"Start off by telling them the name and the aim of the game and then present the game as a storyboard. Be enthusiastic but resist the temptation to get carried away. Just because they're talking to you doesn't mean they'll be easily sold on the idea.

"If possible, get an advance but in every case insist that you have a signed contract, making sure you let a solicitor see it before you accept. Don't be in a rush to sign, if your idea's good, they'll wait.

"Ask about what will happen if the game is released abroad and, if the company has an affiliate label in the States make sure that you get a percentage of the American income and not merely a one-off rights payment.

"If the game is going to be converted to a range of computer systems ask for a percentage as the originating author."

Dave is also sceptical when it comes to launching anything into the USA market.

"A game has to be cost effective for a publisher to be interested. If it's going to the States it must be convertible to the PC because 45-50% of the machines over there are PC. Don't be fooled by offers of vast ST sales - the ST is dead and ready for burial over there."

When asked what programs he'd like to have designed, Dave's memory goes back a long way.

"I'd like to have designed *Elite* at the time it was launched. Looking back, the game seems fairly trivial now but at the time it was a major breakthrough.

"Other games in my top ten include the Macintosh version of *Deja Vu* and *Hitchhiker's Guide to the Galaxy*. *Revs* I rate as the best every driving game and Electronic Arts' *MULE* is a long time favourite.

"Although I'm currently hooked

on *Dungeon Master*, *Sentinel* stands head and shoulders above any other game I've ever seen. It's 100% original and Geoff Crammond is nothing short of a genius in my opinion. A truly great mind.

"Next to Crammond, I also respect Jeremy Sans' and David Braben's work."

*Sentinel* is yet another area for agreement between Dave and Tony. As free agents, it's not a forgone conclusion that their professional lives will run parallel for long. The bond of respect that obviously links them should ensure they work on several more projects before the call of other challenges becomes too strong to resist.



### The Ratt Pack

*Alligata*  
Son of Bagger

*Gremlin*  
Potty Pigeon  
Monty Mole

*Wizard Developments*  
Black Thunder  
Griffin  
William Wobbler

*Alligata*  
Trap  
Kettle

*Ariolasoft*  
Killer Rings  
Gobots  
Centurians

*Image Works*  
Zig Zag  
Fernandez Must Die  
Bombuzal



### Bish's Pieces or some of them!

*Mirrorsoft*  
Caesar the Cat

*Ocean*  
Chinese Juggler  
Chink

*Ariolasoft*  
Golf Construction Set  
Deactivators  
They Stole A Million  
Mean Streak

*Image Works*  
Zig Zag  
Fernandez Must Die  
Bombuzal



# Software for Sale

*If you think that one of our programs looks very interesting, but you can't afford the time to type it in then our software service will help you out*

**I**t's three o'clock in the morning. You sit at the computer keyboard having just finished a marathon typing session entering one of the superb programs from *Your Commodore*. Your fingers reach for the keyboard and press the letters R, U and N. You press RETURN, sit back and nothing happens.

Everyone has probably faced this problem. When it does happen it's a matter of spending hours searching through the program for any typing mistakes. No matter how long you look or how many people help you, you can usually guarantee that at least one little bug slips through unnoticed.

The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

INFONET LTD, 5 River Park Estate, Berkhamsted, Herts HP4 1HL.  
Tel: (04427) 76661

Please contact this address for prices and availability.

## The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:



This symbol means that the program is available on cassette.



These programs are available on disk.

## Please Note

Since the programs supplied on cassette are total working versions of the program, we do not put disk-only programs on tape. There is no sense in placing a program that expects to be reading from disk on to tape.

## JULY '88

**EASIPRINT** — Now C16 and Plus/4 owners can access their printer functions with a set of 60 easy to use Basic commands (available on disk only).

**HANDY INPUT ROUTINES** — Make your Basic programs idiot-proof and more attractive with these two Basic input routines (C64).

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**SEPTEMBER 1988**

**MUSIC COMPOSER** - Compose your own three part harmonies on your C64 with this superb package - disk only.

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**SAMPLER 64** - The quality may not be suitable for studio use but you can have great fun using this C64 sound sampler.

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**ORDER CODE**  
**DISK YDSEP88 £6.00**  
**TAPE YCSEP88 £4.00**

**OCTOBER 1988**

**SPRITE LIBRARY** - In this instalment our sprites take on the look of the alphabet (C64)

**SAMPLER 64** - See September 1988 for details (full program on both September and October disks and tapes.)

**SET THE ALARM** - Use the C64's in-built clock as an alarm.

**JACK IN THE BOX** - A handy box utility for Basic and machine code programmers (C64).

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**HI-RES/MULTI/COLOUR PLOTTER** - A selection of plot routines for both Basic and machine code programmers.

(C64)

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**DECEMBER 1988**

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Cassettes or disks are available from March 1986. Please ring the editorial office (01-437 0626) for details of these.

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# Pool of Radiance

*"You are in a dark passageway with a door at the end. You listen at the door and hear hideous noises but still decide to investigate, so you enter and see a small group of orcs playfully torturing a tall, fair girl. The orcs see you and, annoyed at the interruption, lunge at you."*

If you recognise such an encounter, then you have, no doubt, heard of, and probably played, Dungeons and Dragons. If you haven't, then it's about time you started.

Dungeons and Dragons was the first of the so called roleplaying games and directly influenced the writers of the first computer adventures, a whole host of other role playing games and, of course, computer games such as Bard's Tale and the Ultima series.

Many have tried to get the license for the computer version of D&D, or AD&D (Advanced Dungeons and Dragons) as it is now known, but only SSI has succeeded. This is the first game that has resulted from their five year deal with AD&D authors, TSR.

As the game begins, you control a party of six characters that are created by rolling dice to determine their ability scores in Strength, Intelligence, Wisdom, Dexterity, Constitution and Charisma. These scores then decide what type of character they will be. For example, a fighter must be strong to cause more

damage when he hits an opponent, a cleric should be wise so he can pray for spells, a thief should have a high dexterity to enable him to use a bow, and a magic user needs intelligence to learn the spells that he can cast.

You can then decide whether the character will be human, elf, dwarf, halfling or gnome. You can use the icon editor to design how each character will appear on screen or, if you want to start playing straight away, load up the sample party on the disk that contains one fighter, a fighter magician (multi-class characters are allowed), two clerics, a fighter thief and a magic user. When your party is assembled, you begin the game by entering into the city of Phlan.

This was once a great city that gradually fell on hard time as thugs, villains and monsters moved in. Now the council is trying to regain the city it once ruled and to expand its influence from the small confines of the civilised area into the hostile occupied areas. To this end the council is hiring groups of adventurers to clear areas of the old city. In this game to

clear means to risk your life in battles with hideous monsters, evil gang leaders and powerful magic users that see your presence as a minor irritation.

Naturally, it's cash on delivery, once you've completed the mission, and they'll also pay a bounty for gang leaders killed and for any maps and books that were written in the old times. With only a slight feeling of uneasiness, you head off into the area known as the slums.

The screen display is similar to many seen in computer roleplaying games and is split into four areas. The main screen is a 3D view of what your party can see and alongside it there is a display that shows the names of your party members, their current armour class (how difficult it is to hit them; the lower the value, the better) and the number of hit points they have remaining. If this figure reaches zero, then the character is unconscious and probably dying.

Beneath this display is a message window and the first of a series of duckshoot menus. These joystick controlled menus allow you to carry







out all the commands and actions that sets this apart from other games. For example, your magic users can memorise, scribe and cast spells, clerics can pray for spells and turn away the undead, fighters can select weapons and thieves can fire thier bows. The party can also set up camp to rest and heal, trade items and examine them to see whether they are magical.

When you meet a group of monsters, you can elect, from options, to attack them, wait and see what they are going to do, run away from them or talk to them in a variety of ways. Sometimes they will retreat or give away valuable information, such as the location of their treasure, but usually these encounters lead to combat.

Whenever combat occurs, the screen display changes to a full-screen, 3D, Gauntlet-style view of the battle where each combatant attacks in turn until the battle is won or lost. When it's the turn of one of your characters to act, another menu will appear through which your character can move, attack, stand on guard, cast a spell (you pick the target with a cursor) or fire a bow.

To the left of the main screen, you literally get a blow by blow commentary of what's happening. It states whether arrows, spells, swords and axes hit their target and what effect, if any, they had. All this gives you total control over the battle tactics and the fate of your party. Tactics are important and it's up to you to decide your own but you should try and take out the enemy leaders and magic users first, to weaken the resolve of the others. When monsters break and flee you can either pursue them and cut them down, or settle with what you've done and heal your wounds.

The best way to heal wounds is for your clerics to cast spells but, if they

have none or are laying in a pool of blood, then you will have to rest and gain a hit point for every day you are in camp. This is painfully slow and should be used as a last resort as it also leaves you open to attack from wandering monsters.

As you kill monsters and collect items, you will add to your experience points and, perhaps, impress the tutors at the training centre back in civilisation. However, you will also need 1000 gold pieces which may be more difficult to amass than the experience points. Should you manage both criteria, then your character will be trained, get more hit points and gain other benefits. For example, fighters get additional attacks as they reach higher levels and clerics and magic users can learn more spells from a larger selection. In fact, as they climb up through the levels, the magic users become the most powerful characters, despite beginning as the weakest who need the protection of the others.

Also in the city you will find shops selling weapons and objects that you think may be useful, taverns offering hospitality and rest, temples proffering healing at a price, and the council chamber where you will be rewarded for deeds that you have done.

There is a lot more to Pool of Radiance than mere monster bashing and you can even dispense with most of that by opting for quick combat where the computer controls it all. As you get stronger the commissions you can accept will take you further afield, bring you into contact with more game characters and help you piece together the history of Phlan. Then you will begin to notice that something is very wrong and there is evil at work and you are the people to stop it.

The Pool of Radiance is a massive game and is supplied on four double

sided disks that you must copy before you begin so you must make sure you have a stack of nine disks (eight for the game and a ninth for one to save onto) ready before you begin. A disk box would also be useful as there is a fair amount of disk swapping to do and the disk you need is nearly always at the bottom of the pile.

The game disks are accompanied by an instruction book that contains details of the game menus and low level spells, a reference card for C64 game controls, a code wheel that you must use to decipher a copy protection test and the Adventurers journal that contains a host of information such as the monsters you will face and things that you find. These journal entries are numbered and should only be read when the game prompts you to and include maps and fragments of Phlan's history.

Pool of Radiance is a superb role playing game which both benefits and loses out because of the official AD&D label. On the plus side, you are using the weapons and spells you know and fighting the monsters that you have fought before. The minus, that will only effect existing AD&D players, is that the game uses the exact AD&D rules whereas most players only use them as a guide. A small point which is important to some, but most players will enjoy the opportunity to explore the world of Dungeons and Dragons and relish the thought that there are more to come.

**Tony Hetherington**

## Touchline:

**Title:** Pool of Radiance. **Supplier:** SSI (US Gold), Units 2/3, Holford, Birmingham B6 7AX. **Tel:** 021 356 3388. **Price:** £24.99 (Disk only).



# Directory Editor

*Whip your directories into shape*

*and replace chaos with order*



Commodore disk directories suffer from one main drawback; deleting an old file in the middle of the directory leaves an invisible gap which is filled by the next program to be saved.

When you save your next program, its name disappears somewhere in the depths of the directory instead of being added to the end. This can cause great confusion if you save a program which loads in two or more parts and the parts get separated and spread out.

Directory Editor should alleviate this problem, allowing you to rearrange the directory in any way you see fit. It will also simplify various operations such as locking files and reviving scratched or splat files.

Most of the options are fairly self-explanatory and foolproof but a brief resumé of the commands is necessary.

## DIRECTORY

This shows filename, filetype (including DELETED files), splat and locked files (shown respectively by a \* before the file type and a < after it). The directory scrolls up and down under the control of the cursor keys.

Pressing the space bar inserts a space next to the pointer (the > on the left of the screen), and RETURN moves the file beside the pointer to a previously inserted space.

F1 stores the indicated file so that subsequently pressing F1 in other options results in that filename being taken as an input.

ESC returns to the main menu.

## SCRATCH A FILE

The same as Basic SCRATCH.

## UNSCRATCH A FILE

Restores a file which appears in the directory as DEL.

## UNSPLAT A FILE

A splat file is one which was not closed properly. This option will not rebuild files which are splat, but it may allow you to read data and re-write it to another file.

## LOCK A FILE

This allows you to protect a file against being scratched.

## UNLOCK A FILE

This reverses the previous option.

## RENAME A FILE

The same as Basic RENAME.

## ALPHANUMERIC SORT

This sorts all files into alphanumeric order (similar to alphabetical order, but including numbers and punctuation characters). Replying 'Y' to 'Sort by file type?' will group files in the order PRG, REL, SEQ, USR. (If

this order doesn't suit you change SOS in line 1390). Both options place any DELETED files at the end.

## REWRITE DIRECTORY

This option should only be used when all alterations to the directory have been made. Nothing is changed on the disk until you select this.

If you change your mind halfway through and want to leave your disk as it is, press RUN/STOP.

## Run before you work

The program will run, as written, on the Plus/4, C16 and C128, and should be compatible with all drives, although I'm not sure whether it will cope with double sided disks on the 1571. If you have mistyped anything you'll probably have to HEADER your disk again, so try it out first on an unused disk with some dummy programs.





# Listings

*Get it right first time with our deluxe program system  
for the C64.*

**Y**ou may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:  
[CTRL N, DOWN2, LEFT5, BLUE, F3, C3]

This would be achieved by holding

down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS].[C\*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2\*[PI]\*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

## PROGRAM: SYNTAX CHECKER

```
5 REM SYNTAX CHECKER - ERIC DOYLE
10 BL=10 :LN=70 :SA=49152
20 FOR L=0 TO BL:GX=0:FOR D=0 TO
  15
30 READ A:IF A>255THENPRINT"NUMB
  ER TO LARGE":LN=(L*10):STOP
40 GX=GX+A:POKE SA+L*16+D,A:NEXT
  D
50 READ A:IF A<GX THENPRINT"ERR
  OR IN LINE":LN=(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
  20,169,9,141,32,208,141,33,208,1
  847
80 DATA 169,7,141,134,2,169,13,3
  2,210,255,169,64,141,4,3,169,168
  2
90 DATA 192,141,5,3,88,96,120,16
  9,124,141,4,3,169,165,141,5,1566
  85
100 DATA 3,169,14,141,134,2,141,
  32,208,169,6,141,33,208,88,96,15
  85
110 DATA 32,124,165,72,138,72,15
  2,72,162,0,165,20,133,254,165,21
  ,1747
120 DATA 24,101,254,133,254,189,
  0,2,240,18,69,254,133,254,232,18
  9,2346
130 DATA 0,2,240,8,24,101,254,13
  3,254,232,208,233,169,1,141,134,
  2134
140 DATA 2,165,254,74,74,74,74,3
  2,156,192,32,210,255,165,254,41,
  2054
150 DATA 15,32,156,192,32,210,25
  5,169,13,32,210,255,169,13,32,21
  0,1995
160 DATA 255,169,7,141,134,2,104
  ,168,104,170,104,96,24,105,48,20
  1,1832
170 DATA 58,16,1,96,24,105,7,96,
  0,0,0,0,0,0,0,0,403
```

by Eric Doyle



## Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk

immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and

















press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.









No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time.

VC

### Mnemonic Symbol Keypress

[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

### Mnemonic Symbol Keypress

[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter



# YOUR COMMODORE Listings

## F-Key Labeller



PROGRAM: FUNCTION KEY TEMPLATE  
- C64

```

BB 1 POKE 53280,12
B2 10 REM ****BY C. HOWARD****
AB 20 REM ***COMPLETED 8TH AUGU
ST 1988***
BE 30 REM ***FUNCTION KEY TEMPL
ATE***
DA 100 DIM F$(8):DIM L(8)
7B 110 SPS="SPC7"
32 120 SPC$="SPC8"
D0 130 PRINT"CCLR"
50 140 PRINTTAB(10)"FUNCTION KE
Y LABELLER"
A0 150 PRINTTAB(15)"[DOWN3]1. E
DIT F1"
DD 160 PRINTTAB(15)"2. EDIT F2"
E3 170 PRINTTAB(15)"3. EDIT F3"
99 180 PRINTTAB(15)"4. EDIT F4"
73 190 PRINTTAB(15)"5. EDIT F5"
FD 200 PRINTTAB(15)"6. EDIT F6"
53 210 PRINTTAB(15)"7. EDIT F7"
D1 220 PRINTTAB(15)"8. EDIT F8"
A1 230 PRINTTAB(10)"[DOWN2]PLEA
SE ENTER CHOICE"
93 240 PRINTTAB(15)"[DOWN2,RVSO
N]P[RVS OFF] TO PRINT"
6C 250 PRINTTAB(15)"[DOWN2,RVSO
N]Q[RVS OFF] TO QUIT"
8C 260 GET A$:IF A$="" THEN 260
23 270 IF A$="1" THEN GOSUB 100
0
2D 280 IF A$="2" THEN GOSUB 200
0
AB 290 IF A$="3" THEN GOSUB 300
0
09 300 IF A$="4" THEN GOSUB 400
0
9B 310 IF A$="5" THEN GOSUB 500
0
AS 320 IF A$="6" THEN GOSUB 600
0
EB 330 IF A$="7" THEN GOSUB 700
0
49 340 IF A$="8" THEN GOSUB 800
0
9C 350 IF A$="P" THEN GOSUB 900
0
47 360 IF A$<>"Q" THEN 130
F3 370 END
29 1000 PRINT"CCLR"
DS 1010 PRINTTAB(10)"LABEL FOR
F1"
B7 1020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
7F 1030 INPUT F$(1)
FC 1060 LET L(1)=LEN(F$(1)):IF
L(1)>8 THEN 1000
BC 1070 RETURN
05 2000 PRINT"CCLR"
46 2010 PRINTTAB(10)"LABEL FOR
F2"
F3 2020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
7E 2050 INPUT F$(2)
E5 2060 LET L(2)=LEN(F$(2)):IF
L(2)>7 THEN 2000
90 2070 RETURN
11 3000 PRINT"CCLR"
D3 3010 PRINTTAB(10)"LABEL FOR
F3"
9F 3020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
2C 3050 INPUT F$(3)
AF 3060 LET L(3)=LEN(F$(3)):IF
L(3)>8 THEN 3000
B7 3070 RETURN
ED 4000 PRINT"CCLR"
7C 4010 PRINTTAB(10)"LABEL FOR
F4"
BB 4020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
2B 4050 INPUT F$(4)
22 4060 LET L(4)=LEN(F$(4)):IF
L(4)>7 THEN 4000
7B 4070 RETURN
D9 5000 PRINT"CCLR"
09 5010 PRINTTAB(10)"LABEL FOR
F5"
17 5020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
B6 5050 INPUT F$(5)
CF 5060 LET L(5)=LEN(F$(5)):IF
L(5)>8 THEN 5000
6F 5070 RETURN
FS 6000 PRINT"CCLR"
1A 6010 PRINTTAB(10)"LABEL FOR
F6"
C3 6020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
65 6050 INPUT F$(6)
7A 6060 LET L(6)=LEN(F$(6)):IF
L(6)>7 THEN 6000
43 6070 RETURN
C1 7000 PRINT"CCLR"
67 7010 PRINTTAB(10)"LABEL FOR
F7"
EF 7020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
10 7050 INPUT F$(7)
6F 7060 LET L(7)=LEN(F$(7)):IF
L(7)>8 THEN 7000
37 7070 RETURN
9D 8000 PRINT"CCLR"
D0 8010 PRINTTAB(10)"LABEL FOR
F8"
DB 8020 PRINTTAB(10)"[DOWN]ENTE
R DETAILS";
DF 8050 INPUT F$(8)
1A 8060 LET L(8)=LEN(F$(8)):IF
L(8)>7 THEN 8000
2B 8070 RETURN
70 9000 FOR I=1 TO 7 STEP2
16 9010 LET F$(I)=F$(I)+RIGHT$
SPC$,8-L(I)
4A 9015 L(I)=8
B4 9020 NEXT I
06 9030 FOR I=2 TO 8 STEP2
8C 9040 LET F$(I)=F$(I)+RIGHT$
SPC$,7-L(I)
C3 9045 L(I)=7
56 9050 NEXT I
94 9060 OPEN#4,"[CA,S*28,CS]"
13 9070 PRINT#4,"[CA,S*28,CS]"
1F 9080 PRINT#4,"[CS-,SPC28,S-]"
DD 9090 PRINT#4,"[CS-,SPC28,S-]"
05 9100 PRINT#4,"[CS-,SPC7,CA,S
11,CS,SPC8,S-]"
B0 9110 PRINT#4,"[CS-]F2[SPC5,S
,SPC11,S-]F1[SPC6,S-]"
57 9120 PRINT#4,"[CS-,SPC7,S-,S
C11,S-,SPC8,S-]"
1E 9130 PRINT#4,"[CS-];F$(2);"
S-,SPC11,S-];F$(1);[CS-]"
4B 9140 PRINT#4,"[CS-,SPC7,S-,S
C11,S-,SPC8,S-]"
01 9150 PRINT#4,"[CQ,S*7,CW,SP
11,CQ,S*8,CW]"
3A 9160 PRINT#4,"[CS-]F4[SPC5,S
,SPC11,S-]F3[SPC6,S-]"
BA 9170 PRINT#4,"[CS-];F$(4);"
S-,SPC11,S-];F$(3);[CS-]"
43 9180 PRINT#4,"[CS-,SPC7,S-,S
C11,S-,SPC8,S-]"
29 9190 PRINT#4,"[CQ,S*7,CW,SP
11,CQ,S*8,CW]"
2A 9200 PRINT#4,"[CS-]F6[SPC5,S
,SPC11,S-]F5[SPC6,S-]"

```



```

26 9210 PRINT#4,"[S-]";F$(6);"[
S-,SPC11,S-]";F$(5);"[S-]"
36 9220 PRINT#4,"[S-,SPC7,S-,SP
C11,S-,SPC8,S-]"
DB 9230 PRINT#4,"[CQ,S*7,CW,SPC
11,CQ,S*8,CW]"
D7 9240 PRINT#4,"[S-JF8[SPC5,S-
,SPC11,S-JF7[SPC6,S-]"
BB 9250 PRINT#4,"[S-,SPC7,S-,SP
C11,S-,SPC8,S-]"
FF 9260 PRINT#4,"[S-]";F$(8);"[
S-,SPC11,S-]";F$(7);"[S-]"
DC 9270 PRINT#4,"[S-,SPC7,S-,SP
C11,S-,SPC8,S-]"
D2 9280 PRINT#4,"[S-,SPC7,C2,S*
11,CX,SPC8,S-]"
70 9290 PRINT#4,"[S-,SPC28,S-]"

46 9300 PRINT#4,"[S-,SPC28,S-]"

C4 9310 PRINT#4,"[C2,S*28,CX]"
60 9320 CLOSE#4
18 9330 RETURN

```

## + 4 Directory Editor



PROGRAM: +4 DIR EDITOR

```

10 GOTO80
20 IFASC(MID$(DF$(W),2,1))=0 THEN
70
30 N=ASC(DF$(W)):FT=NAND7:SL=NAN
D128:LK=NAND64:NMS=MID$(DF$(W),4
,16)
40 IFSL=0ANDFT<>0THENSLS="*":ELS
ESLS=" "
50 IFLKTHENLKS="<":ELSELKS=" "
60 IFASC(DF$(W))<>32THENPRINTCHR
$(34)NMSCHR$(34)" "SL$FT$(FT)LK$
:ELSEPRINTNMS
70 RETURN
80 TRAP680:PRINT"ERR"CHR$(142)
90 DIMDF$(144),Q(16),F$(7):ESS=
CHR$(27)
100 FORT=0:OT07:READFT$(T):NEXT
110 DATADEL,SEQ,PRG,USR,REL,???,
???,???
120 B0$="*****":PO
S$="*****"
130 GRAPHIC1,1
140 FORT=2:OT08:KEYT,"":NEXT:KEY1,
CHR$(133)
150 PRINT"          DISK DIRECTOR
Y EDITOR"CHR$(8)
160 CHAR1,9,1,"DISK DIRECTORY ED
ITOR"
170 PRINT"-----"
"ESS"
180 CHAR1,0,2,"-----"
"
190 GRAPHIC0
200 PRINT"*****INSERT DIS
K INTO DRIVE"
210 PRINT"*****AND PRESS
RETURN."
220 GETKEYAS:IFAS<>CHR$(13)THEN#2
20
230 TRAP740
240 OPEN15,8,15
250 OPENS,8,5,"#"
260 PRINT#15,"U1:S,0,18,0":PRINT
#15,"B-P:5,144"
270 NS="":FORT=1:OT16:GET#5,AS:NS
=NS+AS:NEXT

```

```

280 GET#5,AS:GET#5,AS:GET#5,IDS:
GET#5,AS:IDS=IDS+AS
290 PRINT"*****DISK NAM
E: "NS
300 PRINT"*****ID:
"IDS
310 PRINT"*****OK TO READ DI
RECTORY"ESS"Q":INPUTAS
320 IFLEFT$(AS,1)="N"THENCLOSES:
CLOSE15:TRAP680:GOTO200
330 IFLEFT$(AS,1)<>"Y"THEN#310
340 PRINT"*****READING
DISK DIRECTORY"
350 PRINT"*****PLEASE
WAIT"
360 TT=18:SS=1:C=0
370 GOSUB750
380 IFTT<>0THEN#370
390 TRAP680
400 PRINT"*****1: DIRECTORY
"
410 PRINT"*****2: SCRATCH A FIL
E"
420 PRINT"*****3: UNSCRATCH A F
ILE"
430 PRINT"*****4: UNSPLAT A FIL
E"
440 PRINT"*****5: LOCK A FILE"
450 PRINT"*****6: UNLOCK A FILE
"
460 PRINT"*****7: RENAME A FILE
"
470 PRINT"*****8: ALPHANUMERIC
SORT"
480 PRINT"*****9: REWRITE DIREC
TORY"
490 GETKEYAS:IFAS<"1"ORAS>"9"THE
N490
500 IFAS="9"THEN#530
510 ONVAL(AS)GOSUB1470,830,870,9
80,1040,1050,1120,1210
520 GOTO400
530 PRINT"*****REWRITE DIREC
TORY"
540 PRINT"*****ARE YOU SU
RE"ESS"Q":INPUTAS
550 IFLEFT$(AS,1)="Y"THEN#570
560 IFLEFT$(AS,1)="N"THEN#400:ELS
E#40
570 TRAP740:TT=18:SS=1:C1=0
580 GOSUB630
590 C1=C1+8:IFC1<CTHENIT=T1:SS=S
1:GOTO580
600 PRINT#15,"U"
610 CLOSES:CLOSE15:GRAPHIC1,1:SY
S62364:SYS64756:GRAPHIC0,1
620 PRINT"*****DIRECTORY NOW
REWRITTEN":TRAP:END
630 PRINT#15,"U1:"S;0;TT;SS
640 GET#5,AS:T1=ASC(AS):GET#5,AS
:S1=ASC(AS)
650 FORX=OT07:BP=2+32*X:PRINT#15
,"B-P:"S;BP
660 PRINT#5,DF$(C1+X);
670 NEXT:PRINT#15,"U2:"S;0;TT;SS
:RETURN
680 IFER<>30THENPRINT"*****ERRS(
ER)" ERROR IN LINE"EL:END
690 GRAPHIC1:CHAR1,4,10,"QUIT TO
BASIC: ARE YOU SURE?"
700 GETKEYZS:IFZ$="N"THENGGRAPHIC
0:RESUME
710 IFZ$<>"Y"THEN#700
720 GRAPHIC0:PRINT"CHR$(9)
730 CLOSES:CLOSE15:GRAPHIC1,1:SY
S62364:SYS64756:GRAPHIC0,1:END
740 IFER=30THENRESUME:ELSESCNCLR
:PRINTDSS:PRINTERR$(ER)" IN"EL
750 PRINT#15,"U1:"S;0;TT;SS
760 GET#5,AS:IT=ASC(AS):GET#5,AS
:SS=ASC(AS)
770 FORT=OT07:FORU=OT029:GET#5,A
S:IFAS=" "THENAS=CHR$(0)
780 DF$(C)=DF$(C)+AS

```

```

790 NEXT:IFT<7THENGGET#5,AS:GET#5
,AS
800 IFASC(MID$(DF$(C),2,1))<>0TH
ENLFC
810 C=C+1:NEXT
820 RETURN
830 PR$="*****FILE TO SCRATCH
":GOSUB1910
840 IFT<>1000THENPRINT"*****
FILE NOT FOUND":ELSE#60
850 PRINT"*****PRESS A KEY":GETKEYAS
:RETURN
860 MID$(DF$(J),1,1)=CHR$(0):RET
URN
870 PR$="*****FILE TO UNSCRAT
CH":GOSUB1910
880 IFT<>1000THENPRINT"*****
FILE NOT FOUND":ELSE#900
890 PRINT"*****PRESS A KEY":GETKEYAS
:RETURN
900 PRINT"*****1-SEQ"
910 PRINT"*****2-PRG"
920 PRINT"*****3-USR"
930 PRINT"*****4-REL"
940 PRINT"*****FILE TYPE"ESS"Q":INPUTAS:FT=VAL(
AS)
950 IFFT<10RFT>40RFT<>INT(FT)THE
N#40
960 MID$(DF$(J),1,1)=CHR$(128+FT
)
970 RETURN
980 PR$="*****FILE TO UNSPLAT
":GOSUB1910
990 IFT<>1000THENPRINT"*****
FILE NOT FOUND":ELSE#1010
1000 PRINT"*****PRESS A KEY":GETKEYA
S:RETURN
1010 A=ASC(DF$(J))OR128
1020 MID$(DF$(J),1,1)=CHR$(A)
1030 RETURN
1040 PR$="*****FILE TO LOCK":G
OTO1060
1050 PR$="*****FILE TO UNLOCK"
1060 LL=VAL(AS):GOSUB1910
1070 IFT<>1000THENPRINT"*****
FILE NOT FOUND":ELSE#1090
1080 PRINT"*****PRESS A KEY":GETKEYA
S:RETURN
1090 A=ASC(DF$(J))OR64:IFLL=6THE
NA=AAND191
1100 MID$(DF$(J),1,1)=CHR$(A)
1110 RETURN
1120 PR$="*****FILE TO RENAME
":GOSUB1910
1130 IFT<>1000THENPRINT"*****
FILE NOT FOUND":ELSE#1150
1140 PRINT"*****PRESS A KEY":GETKEYA
S:RETURN
1150 PRINT"*****OLD NAME: "MID
$(DF$(J),4,16)
1160 PRINT"*****NEW NAME
: "ESS"Q":INPUTFF$
1170 IFFF$=" "ORFFF$=" "ORFFF$="?"T
HEN#1160
1180 IFLEN(FFF$)<16THENFFF$=FFF$+CH
R$(160):GOTO1180
1190 MID$(DF$(J),4,16)=FFF$
1200 RETURN
1210 PRINT"*****ALPHANUMERIC
SORT"
1220 PRINT"*****ARE YOU S
URE"ESS"Q":INPUTAS
1230 IFLEFT$(AS,1)="Y"THEN#1250
1240 IFLEFT$(AS,1)="N"THENRETURN
:ELSE#1220
1250 PRINT"*****SORT BY FI
LE TYPE"ESS"Q":INPUTAS
1260 IFLEFT$(AS,1)="N"THENGOTO12
80
1270 IFLEFT$(AS,1)="Y"THENGOTO13
80:ELSEGOTO1250
1280 PRINT"*****DIS
ORTING FILES"

```



```

1290 PRINT "PLEASE WAIT"
1300 FORT=C-1TO1STEP-1
1310 FORT=1TOT
1320 IFASC(MID$(DF$(Y),2,1))-OTH
EN1370
1330 F1$=CHR$(ABS((ASC(DF$(Y-1))
AND7)-0))
1340 F2$=CHR$(ABS((ASC(DF$(Y))AN
D7)-0))
1350 IFF1$+MID$(DF$(Y-1),4,16)<F
2$+MID$(DF$(Y),4,16)THEN1370
1360 XX$=DF$(Y-1):DF$(Y-1)=DF$(Y
):DF$(Y)=XX$
1370 NEXT: NEXT: RETURN
1380 PRINT "*****PLEASE
ORTING FILES"
1390 PRINT "*****PLEASE
WAIT":SOS="24130"
1400 FORT=C-1TO1STEP-1
1410 FORT=1TOT
1420 IFASC(MID$(DF$(Y),2,1))-OTH
EN1460
1430 F1$=CHR$(4-(ASC(DF$(Y-1))AN
D7))+MID$(DF$(Y-1),4,16)
1440 F2$=CHR$(4-(ASC(DF$(Y))AND7
))+MID$(DF$(Y),4,16)
1450 IFF1$>F2$THENXX$=DF$(Y-1):D
F$(Y-1)=DF$(Y):DF$(Y)=XX$
1460 NEXT: NEXT: RETURN
1470 PRINT "*****PLEASE
WAIT":SOS="24130"
1480 PRINTSPC(27) " "
1490 PRINTSPC(27) "SPACE: "
1500 PRINTSPC(27) "ADD SPACE "
1510 PRINTSPC(27) " "
1520 PRINTSPC(27) "RETURN: "
1530 PRINTSPC(27) "MOVE FILE "
1540 PRINTSPC(27) " "
1550 PRINTSPC(27) "CURSR U/D: "
1560 PRINTSPC(27) "MOVE DIR "
1570 PRINTSPC(27) "ECTOR "
1580 PRINTSPC(1)>"SPC(25)"
1590 PRINTSPC(27) "RESC: "
1600 PRINTSPC(27) "MENU "
1610 PRINTSPC(27) " "
1620 PRINTSPC(27) "F1: "
1630 PRINTSPC(27) "STORE FILE "
1640 PRINTSPC(27) "NAME "
1650 PRINTSPC(27) " "
1660 PRINT "*****PLEASE
WAIT":SOS="24130"
1670 PRINT "*****PLEASE
WAIT":SOS="24130"
1680 FORT=OT09:PRINT:W=T:GOSUB20
:NEXT:FP=O:KEY1,CHR$(133)
1690 GETKEYAS:I=INSTR("IT")+CHR$(
13)+CHR$(133)+CHR$(27),AS):IFI=
OTHEN1690
1700 ONIGOTO1710,1730,1760,1800,
1870,1890
1710 IFFP<LFTHENFP=FP+1:PRINTES$
"U"BO$;W=FP+9:GOSUB20
1720 GOTO1690
1730 IFFP>OTHENFP=FP-1:PRINTES$
"W"BO$;W=FP-9:GOSUB20
1740 IFFP>BTHENW=FP-9:GOSUB20
1750 GOTO1690
1760 IFSP=OTHENPRINTPO$ES$ "I
";:SP=1:ELSE1690
1770 FORT=LF+1TOFP+1STEP-1
1780 DF$(I)=DF$(I-1)
1790 NEXT:DF$(FP)=" "
1800 IFSP=OTHEN1690:ELSEDF$(SN)=
DF$(FP):SP=O
1810 IFABS(FP-SN)>9THEN1840
1820 PRINT "*****PLEASE
WAIT":SOS="24130"
1830 W=FP:GOSUB20
1840 PRINTPO$ES$ "D
";
1850 IFFP<LFTHENW=FP+10:GOSUB20
1860 FORT=FP+10:DF$(I)=DF$(I+1)
:NEXT:LF=LF-1:GOTO1690
1870 B$=MID$(DF$(FP),4,16):I=INS
TR(B$,CHR$(160)):IFI=OTHEN1690
1880 KEY1,LEFT$(B$,I-1):GOTO1690
1890 PRINT "*****PLEASE
WAIT":SOS="24130"
1900 FORT=SN+1:DF$(I)=DF$(I+1)
:NEXT:LF=LF-1:SP=O:RETURN
1910 PRINT "*****PLEASE
WAIT":SOS="24130"
1920 PRINTPR$ES$ "Q";:FL$=""
1930 INPUTFL$:IFFL$=""ORLEN(FL$)
>16THEN1920
1940 IFINSTR(FL$,"*")=OTHEN1970
1950 IFINSTR(FL$,"*")<>LEN(FL$)T
HEN1920
1960 FL$=LEFT$(FL$,LEN(FL$)-1):G
OTO1980
1970 IFLEN(FL$)<16THENFL$=FL$+CH
R$(160):GOTO1970
1980 QM=O:IFINSTR(FL$,"?")<>OTHE
NQM=1:GOSUB2030
1990 FORT=OTOC:XX$=MID$(DF$(I),4
,16)
2000 IFQM=1THENFORT=OTOC-1:MID$(
XX$,Q(Y),1)="?":NEXT
2010 IFLEFT$(XX$,LEN(FL$))-FL$TH
ENJ=T:T=999
2020 NEXT: RETURN
2030 K=O:QC=O
2040 DO:K=INSTR(FL$,"?",K+1):IFK
<>OTHENQC=K:K=QC+1
2050 LOOPUNTILK=O
2060 RETURN
2070 N=ASC(DF$(W)):FT=NAND7:SL=N
AND128:LK=NAND64
2080 IFSL=OANDFT<>OTHENSL$="*":E
LSESL$=""
2090 IFLKTHENLK$="<":ELSELK$=""
2100 PRINTCHR$(34)MID$(DF$(W),4,
16)CHR$(34) "SL$FT$(FT)LK$;
2110 RETURN

```

```

2F 8 DATA0,53,224,8,240,4,232,7
6,153,64,162,0,189,114,67,32
,210,255,224,35,240,5
7F 9 DATA232,76,166,64,234,165,
197,201,56,240,9,201,27,208,
246,169,8,76,198,64,169
7C 10 DATA1,141,213,64,169,15,1
62,150,160,67,32,189,255,169
,1,162,8,160,1,32,186
35 11 DATA255,169,0,141,251,0,1
69,48,141,252,0,162,0,160,52
,169,251,234,32,216,255
CB 12 DATA96,0,147,19,5,80,76,6
9,65,83,69,32,87,65,73,84,32
,87,72,73,76,69,32,67
44 13 DATA72,65,82,65,67,84,69,
82,83,32,65,82,69,32,67,79,8
0,73,69,68,32,32,32,32
7E 14 DATA32,32,32,68,79,85,66,
76,69,32,72,69,73,71,72,84,3
2,66,89,32,67,76,73,86
86 15 DATA69,32,72,79,82,78,69,
82,112,127,124,108,113,123,1
01,108,121,120,127,118
75 16 DATA113,32,116,113,98,101
,116,99,32,127,119,32,124,11
8,98,126,113,32,116,121
EB 17 DATA114,106,113,114,17,17
,83,65,86,69,32,67,72,65,82,
83,32,84,79,32,40,49
3C 18 DATA41,45,84,65,80,69,32,
79,82,32,40,56,41,45,68,73,8
3,67,68,66,76,32,72,69
1D 19 DATA73,71,72,84,32,67,72,
65,82,83,32,255
55 20 DATA100,112,127,124,108,1
13,123,101,116,98,117,97,118
,103,106,121,111,107
OE 21 DATA114,110,99,120,126,11
5,125,119,109,-1
DB 22 POKE646,1:PRINTCHR$(147);
CHR$(19);"PLEASE WAIT READIN
G IN DATA"
9D 23 FORAD=16384TO16624:READMC
:POKEAD,MC:CO=CO+MC:NEXT
1D 24 IFCO<>29097THENPRINT"ERRO
R IN DATA":END
4B 25 CO=O
DC 26 FORAD=17152TO17319:READMC
:POKEAD,MC:CO=CO+MC:NEXT
F9 27 IFCO<>12373THENPRINT"ERRO
R IN DATA":END
B4 28 SYS16384
2A 29 FORA=53248TO53248+208STEP
8
F5 30 FORQ=ATO+3
6C 31 FORT=OT01:POKE 12800+Y+Z,
PEEK(Q):NEXTY:Z=Z+2:NEXTQ:NE
XTA
F3 32 FORA=53252TO53252+208 STE
P8
5E 33 READM:IFM=-1THEN37
1A 34 Z=O
00 35 FORQ=ATO+3
B3 36 FORT=OT01:POKE(M*8+12288)
+Y+Z,PEEK(Q):NEXTY:Z=Z+2:NEX
TQ:NEXTA
31 37 POKE1,55
79 38 POKE56334,1
5C 39 SYS16448

```

## Double Height



## PROGRAM: DBL HEIGHT CHARACTER

```

1A 0 POKE52,48:POKE56,48:CLR
CS 1 DATA169,0,141,32,208,141,3
3,208,162,0,189,0,67,224,43,
240,7,232,32,210,255,76
3B 2 DATA10,64,162,0,142,14,220
,169,51,133,1,189,0,208,157,
0,48,224,255,240,4,232
13 3 DATA76,33,64,162,0,189,0,2
09,157,0,49,224,255,240,4,23
2,76,49,64,96,169,147
FE 4 DATA32,210,255,169,19,32,2
10,255,169,7,162,0,157,0,216
,224,64,240,4,232,76,78
32 5 DATA64,169,3,162,0,157,40,
216,224,64,240,4,232,76,93,6
4,169,29,141,24,208,162
49 6 DATA0,189,49,67,157,4,4,28
4,28,240,4,232,76,111,64,162
,0,189,85,67,157,44,4
E4 7 DATA224,28,240,4,232,76,12
7,64,169,17,32,210,255,32,21
0,255,162,0,169,255,157

```

## PROGRAM: DBL CHARACTER DEMO

```

7B 2 REM*****DEMO*****MAKE SURE
DOUBLE CHARACTER PROGRAM HAS
BEING EXECUTED FIRST**
8C 3 REM
A9 5 POKE52,48:POKE56,48
57 10 A=A+1
27 20 IFA=1THENLOAD"DBL HEIGHT
CHAR",8,1

```



# Listings

```

E9 22 POKE53272,29
1E 30 POKE53280,0:POKE53281,0:P
    RINT"[CLR,HOME]"
14 40 POKE646,2:PRINT"[SD,SE,SM
    ,SO] [SS,SH,SO,SW,SI,SN,SG]
    [SD,SO,SU,SB,SL,SE] [SH,SE,S
    I,SG,SH,SI] [SC,SH,SA,SR,SA,
    SC,SI,SE,SR,SS]"
9B 50 POKE646,7:PRINT"[CD,CE,CM
    ,CO] [CS,CH,CO,CW,CI,CN,CG]
    [CD,CO,CU,CB,CL,CE] [CH,CE,C
    I,CG,CH,CI] [CC,CH,CA,CR,CA,
    CC,CI,CE,CR,CS]"
D2 60 POKE646,10:PRINT"[SI,ST]
    [SC,SA,SN] [SE,SA,SS,SI,SL,S
    Y] [SB,SE] [SU,SS,SE,SD] [SI
    ,SN] [SY,SO,SU,SR] [SP,SR,SO
    ,SG,SR,SA,SM,SS]"
1F 70 POKE646,3:PRINT"[CI,CT] [
    CC,CA,CN] [CE,CA,CS,CI,CL,CY
    ] [CB,CE] [CU,CS,CE,CD] [CI,
    CN] [CY,CO,CU,CR] [CP,CR,CO,
    CG,CR,CA,CM,CS]"
DF 80 POKE646,13:PRINT"[SA,SS]
    [SS,SH,SO,SW,SN] [SB,SY] [SI
    ,SH,SI,SS] [SD,SE,SM,SO] [SW
    ,SH,SI,SC,SH] [SL,SO2,SK,SS]
    [SG,SR,SE,SA,ST]"
D6 90 POKE646,14:PRINT"[CA,CS]
    [CS,CH,CO,CW,CN] [CB,CY] [CI
    ,CH,CI,CS] [CD,CE,CM,CO] [CW
    ,CH,CI,CC,CH] [CL,CO2,CK,CS]
    [CG,CR,CE,CA,CT]"
SC 100 GOTO 100

```

```

99 32 REM*****
*****
65 40 REM* REPLACE "FILENAME" W
    ITH THE *
77 50 REM* NAME OF THE PROGRAM
    YOU NEED *
E6 51 REM*****
*****
88 60 REM* WHEN LOADING, CALL T
    HIS LOADER*
8F 70 REM* FIRST
*
F2 71 REM*****
*****
29 80 REM* THIS LOADER CAN BE I
    MPROVED *
C2 90 REM* WITH SOME OF THE PRO
    TECTION *
F6 91 REM* METHODS IN THE ARTIC
    LE *
FO 92 REM* USE THE AUTORUN PROG
    RAM TO *
4B 93 REM* MAKE THIS LOADER AUT
    ORUN, *
47 94 REM* INSTALLING THE PROTE
    CTION FOR *
2C 95 REM* YOUR MAIN PROGRAM
*
D9 96 REM*****
*****
SC 97 REM* DELETE ALL THE REMS
    BEFORE USE*
17 98 REM*****
*****
AE 99 REM MAIN PROGRAM STARTS H
    ERE
DB 100 CLR:REM CLEARS VARIABLES
*
A1 110 NAMES="LOAD"+CHR$(34)+"F
    ILENAME"+CHR$(34)+"",B,1"+CHR
    $(0)
29 120 REM SETS UP STRING FOR I
    NPUT
AB 130 FOR J=1TOLEN(NAMES):POKE
    S11+J,ASC(MID$(NAMES,J)):NEX
    TJ
DF 140 REM POKES THE STRING INT
    O THE INPUT BUFFER AT 51
    2
AE 150 POKE198,3:POKE631,82:POK
    E632,213:POKE633,13
AD 160 REM PUTS RUN(R SHIFTED U
    ) AND RETURN INTO KEYBOAR
    D BUFFER
AE 170 REM SETS QUEUE (198)=3 K
    EYPRESSES
F2 180 POKE781,255:POKE782,1
FC 190 REM SETS POINTER FOR INP
    UT TO POINT TO 512
10 200 SYS42118
07 210 REM CALLS ROM ROUTINE TO
    INPUT LINE, SIMULATING K
    EYBOARD ENTRY

```

```

C9 80 REM*****
*****
01 85 REM* THE PROGRAM IS SLOW
    IN BASIC *
AD 90 REM* USE C-ZAP COMPILER T
    O SPEED UP*
FA 95 REM*****
*****
21 100 PRINT"[CLR,WHITE]MESSAGE
    TO PUT BEFORE PROGRAM"
EC 110 INPUTMESSAGES
4D 120 INPUT"[DOWN]NAME OF ORIG
    INAL PROGRAM";NAMES
F5 130 INPUT"[DOWN]NAME OF AUTO
    RUN PROGRAM";BOOTS
D1 140 PRINT"PLACE DISK IN DRIV
    E WITH ORIGINAL[SPC7]PROGRAM
    "
1B 150 PRINT"[DOWN]MAKE SURE TH
    AT THERE IS ROOM FOR THE NEW
    AUTOBOOT PROGRAM[DOWN]"
52 160 PRINT"PRESS RETURN"
53 170 GETAS:IFAS=""THEN170
3E 180 PRINT"[CLR,DOWN2]":PRINT
    MESSAGES
4B 200 OPEN15,8,15,"INITIALIZE"
*
6A 210 OPEN1,8,3,NAMES+",P,R"
2C 220 OPEN2,8,4,BOOTS+",P,W"
8A 230 FORQ=677TO9999
B1 240 READX:IFX<OTHERN300
2C 250 PRINT#2,CHR$(X);:NEXTQ
24 300 FORW=QTO2048
91 310 IFW=808THENPRINT#2,CHR$(
    234);:NEXTW
A6 320 IFW=770THENPRINT#2,CHR$(
    167);:NEXTW
65 330 IFW=771THENPRINT#2,CHR$(
    2);:NEXTW
07 340 PRINT#2,CHR$(PEEK(W));:N
    EXTW
02 400 GET#1,IS,IS
56 410 GET#1,IS:S=ST
DB 420 PRINT#2,CHR$(ASC(T$+CHR$(
    0)));
76 430 IF S=64 THEN CLOSE1:CLOS
    E2:CLOSE15:PRINT"SUCCESSFUL
    AUTORUN":END
85 440 GOTO410
75 500 DATA167,2,169,131,141,2,
    3,169,164,141
EE 510 DATA3,3,169,1,133,43,169
    ,8,133,44,169
77 520 DATA0,168,153,0,216,136,
    208,250,169
FC 530 DATA1,141,33,208,133,162
    ,165,162,208,252
51 540 DATA169,234,141,40,3,32,
    89,166,76,174,167,-1

```

## Program Protection



PROGRAM: INPUT BUFFER

```

AF 10 REM*****
*****
2B 20 REM* CHAINING PROGRAMS US
    ING THE *
0D 30 REM* INPUT BUFFER

```

PROGRAM: AUTORUN CREATE

```

AF 10 REM*****
*****
94 20 REM* AUTOSTART PROGRAM
*
EB 30 REM* PLACES AUTOSTART PRO
    GRAM ON *
C9 40 REM* DISK UNDER NEW NA
    ME *
E7 50 REM*****
*****
2B 60 REM* LOAD NEW PROGRAM WIT
    H *
31 70 REM* LOAD"FILENAME",8,
    1 *

```

## Sprite Controller



PROGRAM: SPRITE PROGRAMMER CODE

```

42 10 I=16384
*
2E 20 READ A:IF A=256 THEN END
57 30 POKE I,A:I=I+1:GOTO 20
B5 16384 DATA 162,4,160,5,24,32
    ,240,255
7B 16392 DATA 169,32,160,64,32,
    30,171,96
3A 16400 DATA 169,48,141,28,4,1
    69,45,141
50 16408 DATA 29,4,169,55,141,3

```



# LISTINGS

0,4,96			
DA 16416 DATA 83,80,82,73,84,69	EA ,26,217,141	7F 17080 DATA 165,250,201,1,176	
,32,80	16752 DATA 50,218,96,75,173,	,3,76,16	
4D 16424 DATA 82,79,71,82,65,77	167,64,73	E4 17088 DATA 66,172,170,64,185	
,77,69	7D 16760 DATA 1,141,168,64,96,2	,0,208,201	
27 16432 DATA 82,32,66,89,32,65	55,0,255	97 17096 DATA 0,240,3,76,16,66,	
,76,65	34 16768 DATA 160,131,140,1,208	165,250	
FD 16440 DATA 78,32,79,66,69,69	,140,3,208	95 17104 DATA 234,37,251,141,16	
,0,0	20 16776 DATA 140,5,208,140,7,2	,208,133,250	
BB 16448 DATA 160,0,185,0,80,15	08,140,9	6E 17112 DATA 172,170,64,169,25	
3,0,4	9D 16784 DATA 208,140,11,208,14	5,153,0,208	
6E 16456 DATA 185,0,81,153,0,5,	0,13,208,140	48 17120 DATA 76,208,65,76,208,	
185,0	13 16792 DATA 15,208,234,234,16	65,0,32	
97 16464 DATA 82,153,0,6,185,24	0,0,169,33	E7 17128 DATA 253,174,32,212,22	
8,82,153	OF 16800 DATA 153,0,208,200,200	5,32,253,174	
19 16472 DATA 248,6,136,208,229	,105,39,192	1F 17136 DATA 32,138,173,32,247	
,32,176,64	3F 16808 DATA 12,208,245,169,19	,183,165,20	
A2 16480 DATA 96,160,0,185,0,84	2,141,16,208	7E 17144 DATA 72,165,21,72,32,2	
,153,0	A9 16816 DATA 169,16,141,12,208	53,174,32	
8E 16488 DATA 4,185,0,85,153,0,	,169,56,141	95 17152 DATA 138,173,32,247,18	
5,185	84 16824 DATA 14,208,96,32,48,6	3,166,20,164	
26 16496 DATA 0,86,153,0,6,185,	5,169,0	FO 17160 DATA 21,104,133,252,10	
248,86	CD 16832 DATA 133,198,76,49,234	4,133,251,169	
7C 16504 DATA 153,248,6,136,208	,173,170,64	OE 17168 DATA 251,76,95,225,165	
,229,32,176	47 16840 DATA 10,141,170,64,32,	,250,229,251	
FC 16512 DATA 64,96,160,0,185,0	158,66,234	31 17176 DATA 133,251,96,208,65	
,88,153	24 16848 DATA 32,228,255,240,25	,255,0,255	
CC 16520 DATA 0,4,185,0,89,153,	1,201,145,240	14 17184 DATA 120,169,49,141,20	
0,5	BF 16856 DATA 39,201,17,240,19,	,3,169,234	
C3 16528 DATA 185,0,90,153,0,6,	201,157,240	7B 17192 DATA 141,21,3,88,96,24	
185,248	1D 16864 DATA 95,201,29,240,59,	6,0,255	
DF 16536 DATA 90,153,248,6,136,	201,13,240	5B 17200 DATA 201,140,240,12,76	
208,229,32	OA 16872 DATA 3,76,48,67,32,96,	,208,65,255	
CS 16544 DATA 176,64,96,0,0,54,	66,96	FA 17208 DATA 0,255,0,255,0,105	
0,0	O1 16880 DATA 172,170,64,24,185	,0,255	
7E 16552 DATA 1,0,0,0,0,0,0,0	,1,208,170	B9 17216 DATA 160,0,185,0,128,1	
A6 16560 DATA 160,0,169,1,153,0	CF 16888 DATA 232,138,153,1,208	53,0,4	
,216,153	,76,208,65	FA 17224 DATA 185,0,129,153,0,5	
8B 16568 DATA 0,218,153,0,217,1	E5 16896 DATA 172,170,64,234,18	,185,0	
53,248,218	5,1,208,170	OC 17232 DATA 130,153,0,6,185,2	
F4 16576 DATA 136,208,239,96,12	1F 16904 DATA 202,138,153,1,208	48,130,153	
0,169,209,141	,76,208,65	O1 17240 DATA 248,6,136,208,229	
OB 16584 DATA 20,3,169,64,141,2	1D 16912 DATA 172,170,64,185,0,	,76,208,65	
1,3,88	208,170,202	14 17248 DATA 0,255,0,255,0,255	
DA 16592 DATA 96,32,159,255,166	9B 16920 DATA 138,153,0,208,76,	,0,255	
,198,240,12	208,65,234	1C 17256 DATA 0,255,0,255,0,255	
A7 16600 DATA 202,189,119,2,201	54 16928 DATA 172,170,64,185,0,	,0,255	
,137,240,7	208,201,255	24 17264 DATA 0,255,0,255,0,255	
E5 16608 DATA 201,138,240,9,76,	F6 16936 DATA 240,9,170,232,138	,0,255	
48,234,238	,153,0,208	2C 17272 DATA 0,255,0,255,0,255	
DF 16616 DATA 32,208,76,187,65,	23 16944 DATA 76,208,65,32,133,	,0,255	
238,33,208	66,169,0	34 17280 DATA 0,255,0,255,0,255	
OS 16624 DATA 76,187,65,160,0,3	O3 16952 DATA 141,172,64,76,208	,0,255	
2,228,255	,65,0,255	3C 17288 DATA 0,255,0,255,0,255	
OS 16632 DATA 240,251,201,3,240	61 16960 DATA 76,184,66,66,67,6	,0,255	
,18,201,13	8,69,255	44 17296 DATA 0,255,0,255,0,255	
D2 16640 DATA 240,14,200,192,3,	8B 16968 DATA 0,255,73,255,0,76	,0,255	
240,238,32	,0,78	4C 17304 DATA 0,255,0,255,0,255	
O2 16648 DATA 210,255,153,0,66,	9F 16976 DATA 162,1,160,1,136,2	,0,255	
76,245,64	08,253,202	54 17312 DATA 0,255,0,255,0,255	
94 16656 DATA 96,255,0,255,0,16	5A 16984 DATA 208,248,96,255,0,	,0,255	
9,1,141	255,0,255	5C 17320 DATA 0,255,0,255,0,255	
E4 16664 DATA 32,216,169,160,14	66 16992 DATA 172,170,64,185,0,	,0,255	
1,33,4,32	208,153,0	64 17328 DATA 0,255,0,255,0,255	
69 16672 DATA 48,65,169,32,141,	D1 17000 DATA 68,185,1,208,153,	,0,255	
33,4,32	1,68,96	6C 17336 DATA 0,255,0,255,0,255	
72 16680 DATA 48,65,96,2,134,24	A1 17008 DATA 173,170,64,10,141,	,0,255	
6,0,255	,171,64,96	74 17344 DATA 0,255,0,255,0,255	
65 16688 DATA 162,64,160,144,13	9D 17016 DATA 160,0,169,160,153	,0,255	
6,208,253,202	,0,68,200	7C 17352 DATA 0,255,0,255,0,255	
B3 16696 DATA 208,248,96,255,0,	3E 17024 DATA 192,17,208,246,96	,0,255	
105,0,255	,173,173,64	84 17360 DATA 0,255,0,255,0,255	
AE 16704 DATA 169,13,141,41,216	6E 17032 DATA 101,250,233,0,141	,0,255	
,141,43,216	,16,208,133	8C 17368 DATA 0,255,0,255,0,255	
SE 16712 DATA 141,45,216,141,57	59 17040 DATA 250,169,0,172,170	,0,255	
,216,141,58	,64,153,0	C2 17376 DATA 71,87,46,76,73,68	
FF 16720 DATA 216,141,59,216,14	80 17048 DATA 208,96,96,255,0,2	,13,73	
1,60,216,141	55,160,0	CE 17384 DATA 76,69,78,65,77,69	
AF 16728 DATA 61,216,141,56,216	19 17056 DATA 185,0,68,153,0,20	,32,255	
,141,193,219	8,185,1	A4 17392 DATA 0,255,0,255,0,255	
19 16736 DATA 141,194,219,141,2	C9 17064 DATA 68,153,1,208,200,	,0,255	
12,219,141,213	234,192,16	AC 17400 DATA 0,255,0,255,0,255	
4D 16744 DATA 219,96,169,13,141	A7 17072 DATA 208,238,165,250,1	,0,255	
	41,16,208,96	6B 17408 DATA 160,160,160,160,1	
		60,160,160,160	



# LISTINGS

73	17416 DATA 160,160,160,160,160,160,160,160	9C	17752 DATA 185,0,71,153,0,5,185,0	FB	18088 DATA 32,32,58,32,19,1,22,5
30	17424 DATA 160,255,0,255,0,255,0,255	D4	17760 DATA 72,153,0,6,185,24,8,72,153	BB	18096 DATA 32,22,1,18,9,1,2,12
33	17432 DATA 0,255,0,255,0,255,0,255	C2	17768 DATA 248,6,136,208,229,96,16,69	62	18104 DATA 5,19,32,32,32,32,32,32
5E	17440 DATA 160,0,32,207,255,192,15,240	4A	17776 DATA 0,255,0,255,0,255,0,255	B9	18112 DATA 32,32,32,32,32,32,32,32
5A	17448 DATA 4,153,224,67,200,201,13,208	12	17784 DATA 0,255,0,255,0,255,0,255	14	18120 DATA 32,32,32,32,109,6,4,125,32
8C	17456 DATA 241,132,252,169,1,166,253,160	5A	17792 DATA 0,255,0,255,0,255,0,255	C9	18128 DATA 32,32,32,32,32,32,32,32
9C	17464 DATA 1,32,186,255,165,252,162,224	22	17800 DATA 0,255,0,255,0,255,0,255	11	18136 DATA 32,32,32,32,32,32,32,32
CF	17472 DATA 160,67,32,189,255,169,0,32	6A	17808 DATA 0,255,0,255,0,255,0,255	D9	18144 DATA 32,32,32,32,32,32,32,32
16	17480 DATA 213,255,96,45,132,46,96,255	B2	17816 DATA 0,255,0,255,0,255,0,255	A1	18152 DATA 32,32,32,32,32,32,32,32
E1	17488 DATA 65,76,65,78,81,81,81,81	7A	17824 DATA 0,255,0,255,0,255,0,255	4C	18160 DATA 32,32,32,32,112,6,4,110,32
FD	17496 DATA 81,81,81,81,81,81,81,81	C2	17832 DATA 0,255,0,255,0,255,0,255	31	18168 DATA 32,32,32,32,32,32,32,32
F2	17504 DATA 0,255,0,255,0,169,147,32	8A	17840 DATA 0,255,0,255,0,255,0,255	EO	18176 DATA 32,32,32,32,32,32,32,32
80	17512 DATA 210,255,169,48,13,3,252,169,2	52	17848 DATA 0,255,0,255,0,255,0,255	08	18184 DATA 32,32,32,32,32,32,32,32
85	17520 DATA 133,253,169,0,133,144,169,36	9A	17856 DATA 0,255,0,255,0,255,0,255	70	18192 DATA 32,32,32,32,32,32,32,32
4F	17528 DATA 133,251,169,251,1,33,187,169,0	62	17864 DATA 0,255,0,255,0,255,0,255	10	18200 DATA 32,32,32,32,93,14,0,93,32
A2	17536 DATA 133,188,165,253,1,33,183,169,8	AA	17872 DATA 0,255,0,255,0,255,0,255	E4	18208 DATA 32,32,58,32,12,15,1,4
40	17544 DATA 133,186,169,96,13,3,185,32,213	F2	17880 DATA 0,255,0,255,0,255,0,255	10	18216 DATA 32,22,1,18,9,1,2,12
E7	17552 DATA 243,165,186,32,18,0,255,165,185	BA	17888 DATA 0,255,0,255,0,255,0,255	E7	18224 DATA 5,19,32,32,32,32,32,32
AO	17560 DATA 32,150,255,164,14,4,208,61,160	02	17896 DATA 0,255,0,255,0,255,0,255	38	18232 DATA 32,32,32,32,32,32,32,32
3C	17568 DATA 6,132,251,32,165,255,166,252	CA	17904 DATA 0,255,0,255,0,255,0,255	4F	18240 DATA 32,32,32,32,109,6,4,125,32
EO	17576 DATA 133,252,164,144,2,08,46,164,251	92	17912 DATA 0,255,0,255,0,255,0,255	48	18248 DATA 32,32,32,32,32,32,32,32
84	17584 DATA 136,208,238,164,2,52,32,205,189	F9	17920 DATA 32,32,32,32,32,32,32,32	B0	18256 DATA 32,32,32,32,32,32,32,32
11	17592 DATA 169,32,32,210,255,32,165,255	C2	17928 DATA 32,32,32,112,64,6,4,64,64	58	18264 DATA 32,32,32,32,32,32,32,32
3F	17600 DATA 166,144,208,65,17,0,240,6,32	69	17936 DATA 64,64,64,64,64,64,64,64	40	18272 DATA 32,32,32,32,32,32,32,32
F2	17608 DATA 210,255,76,189,68,169,13,32	AB	17944 DATA 64,64,110,32,32,3,2,32,32	43	18280 DATA 32,32,32,32,112,6,4,110,32
23	17616 DATA 210,255,165,197,2,01,63,240,4	19	17952 DATA 32,32,32,32,32,32,32,32	50	18288 DATA 32,32,32,32,32,32,32,32
CO	17624 DATA 160,4,208,197,32,66,246,169	E1	17960 DATA 32,32,32,32,32,32,32,32	78	18296 DATA 32,32,32,32,32,32,32,32
C7	17632 DATA 13,32,210,255,169,0,133,144	EA	17968 DATA 32,32,32,93,5,24,20,18	60	18304 DATA 32,32,32,32,32,32,32,32
CD	17640 DATA 169,8,133,186,32,180,255,169	DE	17976 DATA 1,32,3,15,13,13,1,14	88	18312 DATA 32,32,32,32,32,32,32,32
48	17648 DATA 111,133,185,32,15,0,255,164,144	00	17984 DATA 4,19,93,32,32,32,32,32	CF	18320 DATA 32,32,32,32,93,17,6,93,32
E7	17656 DATA 208,10,32,165,255,32,210,255	01	17992 DATA 32,32,32,32,32,32,32,32	92	18328 DATA 32,32,58,32,13,21,12,20
20	17664 DATA 201,13,208,242,32,171,255,96	49	18000 DATA 32,32,32,32,32,32,32,32	CC	18336 DATA 9,45,3,15,12,15,2,1,18
A2	17672 DATA 0,255,0,255,0,255,0,255	8A	18008 DATA 32,32,32,109,64,6,4,64,64	BB	18344 DATA 32,48,32,61,32,32,32,32
E3	17680 DATA 32,207,255,201,13,240,25,201	B9	18016 DATA 64,64,64,64,64,64,64,64	90	18352 DATA 32,32,32,32,32,32,32,32
03	17688 DATA 30,240,21,201,31,240,49,76	1A	18024 DATA 64,64,125,32,32,3,2,32,32	37	18360 DATA 32,32,32,32,109,6,4,125,32
EF	17696 DATA 16,69,96,255,0,76,80,69	69	18032 DATA 32,32,32,32,32,32,32,32	AO	18368 DATA 32,32,32,32,32,32,32,32
D5	17704 DATA 0,255,0,255,146,2,46,0,255	34	18040 DATA 32,32,32,32,112,6,4,110,32	CB	18376 DATA 32,32,32,32,32,32,32,32
E9	17712 DATA 160,0,185,0,4,153,0,70	79	18048 DATA 32,32,32,32,32,32,32,32	30	18384 DATA 32,32,32,32,32,32,32,32
FA	17720 DATA 185,0,5,153,0,71,185,0	41	18056 DATA 32,32,32,32,32,32,32,32	DB	18392 DATA 32,32,32,32,32,32,32,32
59	17728 DATA 6,153,0,72,185,24,8,6,153	89	18064 DATA 32,32,32,32,32,32,32,32	1B	18400 DATA 32,32,32,32,112,6,4,110,32
55	17736 DATA 248,72,136,208,22,9,96,16,69	D1	18072 DATA 32,32,32,32,32,32,32,32	EB	18408 DATA 32,32,32,32,32,32,32,32
15	17744 DATA 160,0,185,0,70,15,3,0,4	72	18080 DATA 32,32,32,32,93,14,7,93,32	DO	18416 DATA 32,32,32,32,32,32,32,32



# LISTINGS

FB 18424 DATA 32,32,32,32,32,32,32,32	80 18760 DATA 32,32,32,32,112,6,4,64,110	95 19096 DATA 0,255,0,255,0,255,0,255
FF 18432 DATA 32,32,32,32,32,32,32,32	46 18768 DATA 32,32,32,32,32,32,32,32	5D 19104 DATA 0,255,0,255,0,255,0,255
37 18440 DATA 32,32,32,32,93,17,7,93,32	CE 18776 DATA 32,32,32,32,32,32,32,32	A5 19112 DATA 0,255,0,255,0,255,0,255
0B 18448 DATA 32,32,58,32,13,21,12,20	56 18784 DATA 32,32,32,32,32,32,32,32	6D 19120 DATA 0,255,0,255,0,255,0,255
FF 18456 DATA 9,45,3,15,12,15,2,1,18	9E 18792 DATA 32,32,32,32,32,32,32,32	B5 19128 DATA 0,255,0,255,0,255,0,255
09 18464 DATA 32,49,32,61,32,32,32,32	7E 18800 DATA 32,32,32,32,93,13,4,183,93	7D 19136 DATA 0,255,0,255,0,255,0,255
67 18472 DATA 32,32,32,32,32,32,32,32	E4 18808 DATA 32,32,58,32,5,24,9,20	C5 19144 DATA 0,255,0,255,0,255,0,255
1E 18480 DATA 32,32,32,32,109,6,4,125,32	76 18816 DATA 32,32,32,32,32,32,32,32	8D 19152 DATA 0,255,0,255,0,255,0,255
F7 18488 DATA 32,32,32,32,32,32,32,32	3E 18824 DATA 32,32,32,32,32,32,32,32	D5 19160 DATA 0,255,0,255,0,255,0,255
3F 18496 DATA 32,32,32,32,32,32,32,32	86 18832 DATA 32,32,32,32,32,32,32,32	9D 19168 DATA 0,255,0,255,0,255,0,255
87 18504 DATA 32,32,32,32,32,32,32,32	98 18840 DATA 32,32,32,32,109,6,4,64,125	E5 19176 DATA 0,255,0,255,0,255,0,255
4F 18512 DATA 32,32,32,32,32,32,32,32	96 18848 DATA 32,32,32,32,32,32,32,32	AD 19184 DATA 0,255,0,255,0,255,0,255
8E 18520 DATA 32,32,32,32,112,6,4,110,32	DE 18856 DATA 32,32,32,32,32,32,32,32	F5 19192 DATA 0,255,0,255,0,255,0,255
5F 18528 DATA 32,32,32,32,32,32,32,32	A6 18864 DATA 32,32,32,32,32,32,32,32	BC 19200 DATA 0,255,0,255,0,255,0,255
A7 18536 DATA 32,32,32,32,32,32,32,32	AE 18872 DATA 32,32,32,32,32,32,32,32	C4 19208 DATA 0,255,0,255,0,255,0,255
6F 18544 DATA 32,32,32,32,32,32,32,32	B6 18880 DATA 32,32,32,32,32,32,32,32	CC 19216 DATA 0,255,0,255,0,255,0,255
37 18552 DATA 32,32,32,32,32,32,32,32	7E 18888 DATA 32,32,32,32,32,32,32,32	D4 19224 DATA 0,255,0,255,0,255,0,255
CA 18560 DATA 32,32,32,32,93,14,1,93,32	C6 18896 DATA 32,32,32,32,32,32,32,32	DC 19232 DATA 0,255,0,255,0,255,0,255
B5 18568 DATA 32,32,58,32,12,15,1,4	4E 18904 DATA 32,32,32,32,32,32,32,32	B8 19240 DATA 0,255,0,255,150,2,46,0,255
9A 18576 DATA 32,19,16,18,9,20,5,19	D6 18912 DATA 32,32,32,32,32,32,32,32	EC 19248 DATA 0,255,0,255,0,255,0,255
57 18584 DATA 32,32,32,32,32,32,32,32	67 18920 DATA 32,109,64,125,96,32,32,32	02 19256 DATA 0,255,0,255,0,105,0,255
9F 18592 DATA 32,32,32,32,32,32,32,32	E6 18928 DATA 32,32,32,32,32,32,32,32	FC 19264 DATA 0,255,0,255,0,255,0,255
66 18600 DATA 32,32,32,32,109,6,4,125,32	B6 18936 DATA 0,255,0,255,0,255,0,255	04 19272 DATA 0,255,0,255,0,255,0,255
AF 18608 DATA 32,32,32,32,32,32,32,32	8D 18944 DATA 0,255,0,255,0,255,0,255	0C 19280 DATA 0,255,0,255,0,255,0,255
77 18616 DATA 32,32,32,32,32,32,32,32	05 18952 DATA 0,255,0,255,0,255,0,255	14 19288 DATA 0,255,0,255,0,255,0,255
BF 18624 DATA 32,32,32,32,32,32,32,32	CD 18960 DATA 0,255,0,255,0,255,0,255	1C 19296 DATA 0,255,0,255,0,255,0,255
07 18632 DATA 32,32,32,32,32,32,32,32	15 18968 DATA 0,255,0,255,0,255,0,255	24 19304 DATA 0,255,0,255,0,255,0,255
66 18640 DATA 32,32,32,32,112,6,4,110,32	DD 18976 DATA 0,255,0,255,0,255,0,255	2C 19312 DATA 0,255,0,255,0,255,0,255
97 18648 DATA 32,32,32,32,32,32,32,32	98 18984 DATA 0,255,0,255,134,2,46,0,255	34 19320 DATA 0,255,0,255,0,255,0,255
DF 18656 DATA 32,32,32,32,32,32,32,32	ED 18992 DATA 0,255,0,255,0,255,0,255	3C 19328 DATA 0,255,0,255,0,255,0,255
27 18664 DATA 32,32,32,32,32,32,32,32	AD 19000 DATA 0,255,0,255,0,105,0,255	44 19336 DATA 0,255,0,255,0,255,0,255
EF 18672 DATA 32,32,32,32,32,32,32,32	FD 19008 DATA 0,255,0,255,0,255,0,255	4C 19344 DATA 0,255,0,255,0,255,0,255
F6 18680 DATA 32,32,32,32,93,13,2,93,32	45 19016 DATA 0,255,0,255,0,255,0,255	54 19352 DATA 0,255,0,255,0,255,0,255
59 18688 DATA 32,32,58,32,4,9,1,9,11	0D 19024 DATA 0,255,0,255,0,255,0,255	5C 19360 DATA 0,255,0,255,0,255,0,255
EF 18696 DATA 32,4,9,18,5,3,20,15	55 19032 DATA 0,255,0,255,0,255,0,255	64 19368 DATA 0,255,0,255,0,255,0,255
EA 18704 DATA 18,25,32,32,32,32,32,32	1D 19040 DATA 0,255,0,255,0,255,0,255	6C 19376 DATA 0,255,0,255,0,255,0,255
8E 18712 DATA 32,32,32,32,32,32,32,32	65 19048 DATA 0,255,0,255,0,255,0,255	74 19384 DATA 0,255,0,255,0,255,0,255
59 18720 DATA 32,32,32,32,109,6,4,125,32	2D 19056 DATA 0,255,0,255,0,255,0,255	7C 19392 DATA 0,255,0,255,0,255,0,255
5E 18728 DATA 32,32,32,32,32,32,32,32	75 19064 DATA 0,255,0,255,0,255,0,255	84 19400 DATA 0,255,0,255,0,255,0,255
26 18736 DATA 32,32,32,32,32,32,32,32	3D 19072 DATA 0,255,0,255,0,255,0,255	8C 19408 DATA 0,255,0,255,0,255,0,255
2E 18744 DATA 32,32,32,32,32,32,32,32	85 19080 DATA 0,255,0,255,0,255,0,255	94 19416 DATA 0,255,0,255,0,255,0,255
36 18752 DATA 32,32,32,32,32,32,32,32	4D 19088 DATA 0,255,0,255,0,255,0,255	9C 19424 DATA 0,255,0,255,0,255,0,255



# LISTINGS

A4	19432 DATA 0,255,0,255,0,255	E4	19768 DATA 0,255,0,255,0,105	49	20104 DATA 0,255,0,255,0,255
AC	19440 DATA 0,255,0,255,0,255	E2	19776 DATA 0,255,0,255,0,255	91	20112 DATA 0,255,0,255,0,255
B4	19448 DATA 0,255,0,255,0,255	2A	19784 DATA 0,255,0,255,0,255	59	20120 DATA 0,255,0,255,0,255
A3	19456 DATA 0,255,0,255,0,255	72	19792 DATA 0,255,0,255,0,255	A1	20128 DATA 0,255,0,255,0,255
EB	19464 DATA 0,255,0,255,0,255	3A	19800 DATA 0,255,0,255,0,255	69	20136 DATA 0,255,0,255,0,255
33	19472 DATA 0,255,0,255,0,255	B2	19808 DATA 0,255,0,255,0,255	B1	20144 DATA 0,255,0,255,0,255
FB	19480 DATA 0,255,0,255,0,255	4A	19816 DATA 0,255,0,255,0,255	79	20152 DATA 0,255,0,255,0,255
43	19488 DATA 0,255,0,255,0,255	12	19824 DATA 0,255,0,255,0,255	C1	20160 DATA 0,255,0,255,0,255
1F	19496 DATA 0,255,0,255,150,2	5A	19832 DATA 0,255,0,255,0,255	89	20168 DATA 0,255,0,255,0,255
D3	19504 DATA 0,255,0,255,0,255	22	19840 DATA 0,255,0,255,0,255	D1	20176 DATA 0,255,0,255,0,255
E7	19512 DATA 0,255,0,255,0,105	6A	19848 DATA 0,255,0,255,0,255	99	20184 DATA 0,255,0,255,0,255
E3	19520 DATA 0,255,0,255,0,255	B2	19856 DATA 0,255,0,255,0,255	E1	20192 DATA 0,255,0,255,0,255
2B	19528 DATA 0,255,0,255,0,255	7A	19864 DATA 0,255,0,255,0,255	A9	20200 DATA 0,255,0,255,0,255
73	19536 DATA 0,255,0,255,0,255	C2	19872 DATA 0,255,0,255,0,255	F1	20208 DATA 0,255,0,255,0,255
3B	19544 DATA 0,255,0,255,0,255	8A	19880 DATA 0,255,0,255,0,255	B9	20216 DATA 0,255,0,255,0,255
83	19552 DATA 0,255,0,255,0,255	52	19888 DATA 0,255,0,255,0,255	A0	20224 DATA 0,255,0,255,0,255
4B	19560 DATA 0,255,0,255,0,255	9A	19896 DATA 0,255,0,255,0,255	EB	20232 DATA 0,255,0,255,0,255
13	19568 DATA 0,255,0,255,0,255	62	19904 DATA 0,255,0,255,0,255	30	20240 DATA 0,255,0,255,0,255
5B	19576 DATA 0,255,0,255,0,255	AA	19912 DATA 0,255,0,255,0,255	FB	20248 DATA 0,255,0,255,0,255
23	19584 DATA 0,255,0,255,0,255	F2	19920 DATA 0,255,0,255,0,255	40	20256 DATA 0,255,0,255,0,255
6B	19592 DATA 0,255,0,255,0,255	BA	19928 DATA 0,255,0,255,0,255	19	20264 DATA 0,255,0,255,150,2
B3	19600 DATA 0,255,0,255,0,255	02	19936 DATA 0,255,0,255,0,255	54	0,255
7B	19608 DATA 0,255,0,255,0,255	02	19936 DATA 0,255,0,255,0,255	D0	20272 DATA 0,255,0,255,0,255
C3	19616 DATA 0,255,0,255,0,255	CA	19944 DATA 0,255,0,255,0,255	57	20280 DATA 0,255,0,255,0,41
8B	19624 DATA 0,255,0,255,0,255	92	19952 DATA 0,255,0,255,0,255	0,255	
53	19632 DATA 0,255,0,255,0,255	DA	19960 DATA 0,255,0,255,0,255	EO	20288 DATA 0,255,0,255,0,255
9B	19640 DATA 0,255,0,255,0,255	01	19968 DATA 0,255,0,255,0,255	28	20296 DATA 0,255,0,255,0,255
63	19648 DATA 0,255,0,255,0,255	C9	19976 DATA 0,255,0,255,0,255	70	20304 DATA 0,255,0,255,0,255
AB	19656 DATA 0,255,0,255,0,255	11	19984 DATA 0,255,0,255,0,255	38	20312 DATA 0,255,0,255,0,255
F3	19664 DATA 0,255,0,255,0,255	D9	19992 DATA 0,255,0,255,0,255	80	20320 DATA 0,255,0,255,0,255
BB	19672 DATA 0,255,0,255,0,255	21	20000 DATA 0,255,0,255,0,255	48	20328 DATA 0,255,0,255,0,255
03	19680 DATA 0,255,0,255,0,255	29	20008 DATA 0,255,0,255,150,2	10	20336 DATA 0,255,0,255,0,255
CB	19688 DATA 0,255,0,255,0,255	31	20016 DATA 0,255,0,255,0,255	58	20344 DATA 0,255,0,255,0,255
93	19696 DATA 0,255,0,255,0,255	82	20024 DATA 0,255,0,255,0,41	20	20352 DATA 0,255,0,255,0,255
DB	19704 DATA 0,255,0,255,0,255	41	20032 DATA 0,255,0,255,0,255	68	20360 DATA 0,255,0,255,0,255
A2	19712 DATA 0,255,0,255,0,255	09	20040 DATA 0,255,0,255,0,255	80	20368 DATA 0,255,0,255,0,255
EA	19720 DATA 0,255,0,255,0,255	51	20048 DATA 0,255,0,255,0,255	78	20376 DATA 0,255,0,255,0,255
32	19728 DATA 0,255,0,255,0,255	19	20056 DATA 0,255,0,255,0,255	CO	20384 DATA 0,255,0,255,0,255
FA	19736 DATA 0,255,0,255,0,255	61	20064 DATA 0,255,0,255,0,255	88	20392 DATA 0,255,0,255,0,255
42	19744 DATA 0,255,0,255,0,255	29	20072 DATA 0,255,0,255,0,255	50	20400 DATA 0,255,0,255,0,255
19	19752 DATA 0,255,0,255,130,2	71	20080 DATA 0,255,0,255,0,255	98	20408 DATA 0,255,0,255,0,255
D2	19760 DATA 0,255,0,255,0,255	39	20088 DATA 0,255,0,255,0,255	60	20416 DATA 0,255,0,255,0,255
		81	20096 DATA 0,255,0,255,0,255	AB	20424 DATA 0,255,0,255,0,255
				FO	20432 DATA 0,255,0,255,0,255



# LISTINGS

BB	20440 DATA 0,255,0,255,0,255,0,255	EE	20776 DATA 67,91,67,91,67,91,67,91		48,93
00	20448 DATA 0,255,0,255,0,255,0,255	C3	20784 DATA 64,91,64,91,64,91,64,115	3D	21112 DATA 32,32,32,32,32,32,32,32
CB	20456 DATA 0,255,0,255,0,255,0,255	36	20792 DATA 32,32,32,32,32,32,32,32	B5	21120 DATA 32,32,32,32,32,32,32,32
90	20464 DATA 0,255,0,255,0,255,0,255	39	20800 DATA 32,109,64,125,32,32,32,32	06	21128 DATA 32,32,32,32,32,32,32,109
2C	20472 DATA 0,255,0,255,0,255,0,255	49	20808 DATA 32,32,32,32,32,32,32,93	F1	21136 DATA 64,113,64,113,64,113,64,113
6E	20480 DATA 112,64,64,64,64,64,64,110,32	06	20816 DATA 48,93,48,93,48,93,48,93	7E	21144 DATA 64,113,64,113,64,113,64,125
3C	20488 DATA 32,32,32,32,32,32,32,112	CE	20824 DATA 48,93,48,93,48,93,48,93	A5	21152 DATA 32,32,32,32,32,32,32,32
76	20496 DATA 64,64,64,64,64,64,64,110,32	9E	20832 DATA 32,32,32,32,32,32,32,32	ED	21160 DATA 32,32,32,32,32,32,32,32
1F	20504 DATA 32,32,32,32,32,32,32,32	66	20840 DATA 32,32,32,32,32,32,32,32	B5	21168 DATA 32,32,32,32,32,32,32,32
22	20512 DATA 62,32,32,32,32,32,32,32	A3	20848 DATA 32,32,32,32,32,32,32,109	7D	21176 DATA 32,32,32,32,32,32,32,32
BE	20520 DATA 93,133,47,152,47,153,93,32	A6	20856 DATA 64,113,64,113,64,113,64,113	C5	21184 DATA 32,32,32,32,32,32,32,32
FB	20528 DATA 32,32,32,32,32,32,32,93	CB	20864 DATA 64,113,64,113,64,113,64,125	0D	21192 DATA 32,32,32,32,32,32,32,32
FB	20536 DATA 144,129,135,133,160,177,93,32	86	20872 DATA 32,32,32,32,32,32,32,32	D5	21200 DATA 32,32,32,32,32,32,32,32
87	20544 DATA 32,32,32,32,32,32,32,32	0E	20880 DATA 32,32,32,32,32,32,32,32	9D	21208 DATA 32,32,32,32,32,32,32,32
4F	20552 DATA 32,32,32,32,32,32,32,32	96	20888 DATA 32,32,32,32,32,32,32,32	E5	21216 DATA 32,32,32,32,32,32,32,32
96	20560 DATA 109,64,64,64,64,64,64,125,32	DE	20896 DATA 32,32,32,32,32,32,32,32	2D	21224 DATA 32,32,32,32,32,32,32,32
94	20568 DATA 32,32,32,32,32,32,32,109	A5	20904 DATA 32,32,32,32,32,32,32,32	F5	21232 DATA 32,32,32,32,32,32,32,32
68	20576 DATA 64,64,64,64,64,64,64,125,32	AE	20912 DATA 32,32,32,32,32,32,32,32	BD	21240 DATA 32,32,32,32,32,32,32,32
6F	20584 DATA 32,32,32,32,32,32,32,32	86	20920 DATA 32,32,32,32,32,32,32,32	3F	21248 DATA 32,32,32,32,32,32,32,32
37	20592 DATA 32,32,32,32,32,32,32,32	7E	20928 DATA 32,32,32,32,32,32,32,32	04	21256 DATA 64,114,64,114,64,114,64,114
7F	20600 DATA 32,32,32,32,32,32,32,32	C6	20936 DATA 32,32,32,32,32,32,32,32	EB	21264 DATA 64,114,64,114,64,114,64,110
C7	20608 DATA 32,32,32,32,32,32,32,32	4E	20944 DATA 32,32,32,32,32,32,32,32	C4	21272 DATA 32,32,32,32,32,32,32,32
8F	20616 DATA 32,32,32,32,32,32,32,32	D6	20952 DATA 32,32,32,32,32,32,32,32	7F	21280 DATA 32,112,64,110,32,32,32,32
57	20624 DATA 32,32,32,32,32,32,32,32	1E	20960 DATA 32,32,32,32,32,32,32,32	DF	21288 DATA 32,32,32,32,32,32,32,93
9F	20632 DATA 32,32,32,32,32,32,32,32	15	20968 DATA 32,32,32,32,32,32,32,112	98	21296 DATA 48,93,49,93,50,93,51,93
E7	20640 DATA 32,32,32,32,32,32,32,32	BE	20976 DATA 64,114,64,114,64,114,64,114	F2	21304 DATA 52,93,53,93,54,93,55,93
AF	20648 DATA 32,32,32,32,32,32,32,32	C2	20984 DATA 64,114,64,114,64,114,64,110	4C	21312 DATA 32,32,32,32,32,32,32,32
77	20656 DATA 32,32,32,32,32,32,32,32	05	20992 DATA 32,32,32,32,32,32,32,32	06	21320 DATA 32,93,153,93,32,25,45,5
BF	20664 DATA 32,32,32,32,32,32,32,32	4A	21000 DATA 32,112,64,110,32,32,32,32	09	21328 DATA 24,16,1,14,4,45,32,107
07	20672 DATA 32,32,32,32,32,32,32,32	1E	21008 DATA 32,32,32,32,32,32,32,93	1C	21336 DATA 64,91,64,91,64,91,64,91
CF	20680 DATA 32,32,32,32,32,32,32,32	AD	21016 DATA 48,93,49,93,50,93,51,93	71	21344 DATA 64,91,64,91,64,91,64,115
C4	20688 DATA 32,32,32,32,32,32,32,112	23	21024 DATA 52,93,53,93,54,93,55,93	14	21352 DATA 32,32,32,32,32,32,32,32
D7	20696 DATA 64,114,64,114,64,114,64,114	6D	21032 DATA 32,32,32,32,32,32,32,32	08	21360 DATA 32,109,64,125,32,32,32,32
BB	20704 DATA 64,114,64,114,64,114,64,110	B1	21040 DATA 32,93,152,93,32,24,45,5	AF	21368 DATA 32,32,32,32,32,32,32,93
EF	20712 DATA 32,32,32,32,32,32,32,32	82	21048 DATA 24,16,1,14,4,45,32,107	F4	21376 DATA 48,93,48,93,48,93,48,93
D8	20720 DATA 32,112,64,110,32,32,32,32	35	21056 DATA 64,91,64,91,64,91,64,91	3C	21384 DATA 48,93,48,93,48,93,48,93
EO	20728 DATA 32,32,32,32,32,32,32,93	AA	21064 DATA 64,91,64,91,64,91,64,115	9C	21392 DATA 32,32,32,32,32,32,32,32
72	20736 DATA 48,93,49,93,50,93,51,93	55	21072 DATA 32,32,32,32,32,32,32,32	44	21400 DATA 32,32,32,32,32,32,32,32
B4	20744 DATA 52,93,53,93,54,93,55,93	8E	21080 DATA 32,109,64,125,32,32,32,32	E5	21408 DATA 32,32,32,32,32,32,32,109
8E	20752 DATA 32,32,32,32,32,32,32,32	6E	21088 DATA 32,32,32,32,32,32,32,93	44	21416 DATA 64,113,64,113,64,113,64,113
20	20760 DATA 32,93,133,93,32,514,1	1D	21096 DATA 48,93,48,93,48,93,48,93	55	21424 DATA 64,113,64,113,64,113,64,125
8C	20768 DATA 2,12,5,32,32,45,32,107	25	21104 DATA 48,93,48,93,48,93,48,93	E4	21432 DATA 32,32,32,32,32,32,32,32



# LISTINGS

BF	21440 DATA 32,134,177,32,45, 32,14,5	63	,32,32 22024 DATA 32,112,64,110,32, 21,19,5	07	,32,32 21872 DATA 32,32,32,32,32,32, 32,109
C6	21448 DATA 24,20,32,16,1,7,5 ,32	4A	22032 DATA 32,32,32,32,32,32, 32,112	6A	21880 DATA 64,113,64,113,64, 113,64,113
DC	21456 DATA 32,32,32,32,32,32, 32,32	A7	22040 DATA 64,110,32,32,32,3, 2,32,32	37	21888 DATA 64,113,64,113,64, 113,64,125
B4	21464 DATA 32,32,32,32,32,32, 32,32	29	22048 DATA 32,32,32,32,32,32, 32,32	8A	21896 DATA 32,32,32,32,32,32, 32,32
EC	21472 DATA 32,32,32,32,32,32, 32,32	71	22056 DATA 32,32,32,32,32,32, 32,32	52	21904 DATA 32,32,32,32,32,32, 32,32
B4	21480 DATA 64,113,64,113,64, 113,64,113	83	22064 DATA 32,93,149,93,32,1 9,16,18	9A	21912 DATA 32,32,32,32,32,32, 32,32
B2	21488 DATA 64,113,64,113,64, 125,32,32	71	22072 DATA 9,20,5,32,32,45,3 2,93	A2	21920 DATA 32,32,32,32,32,32, 32,32
6C	21496 DATA 32,32,32,32,32,32, 112,64	A1	22080 DATA 48,93,32,32,32,32, 32,32	AA	21928 DATA 32,32,32,32,32,32, 32,32
BA	21504 DATA 112,64,64,64,64,6 4,110,32	91	22088 DATA 32,32,32,32,32,32, 32,32	72	21936 DATA 32,32,32,32,32,32, 32,32
20	21512 DATA 32,32,32,32,32,32, 32,112	59	22096 DATA 32,32,32,32,32,32, 32,32	8A	21944 DATA 32,32,32,32,32,32, 32,32
52	21520 DATA 64,64,64,64,64,64, 110,32	F8	22104 DATA 32,109,64,125,32, 14,15,46	C2	21952 DATA 32,32,32,32,32,32, 32,32
63	21528 DATA 32,32,32,32,32,32, 32,32	9E	22112 DATA 32,63,32,32,32,32, 32,109	CA	21960 DATA 32,32,32,32,32,32, 32,32
5E	21536 DATA 62,32,32,32,32,32, 32,32	BD	22120 DATA 64,125,32,32,32,3, 2,32,32	92	21968 DATA 32,32,32,32,32,32, 32,32
OF	21544 DATA 93,141,47,149,47, 131,93,32	79	22128 DATA 32,32,32,32,32,32, 32,32	87	22224 DATA 96,32,32,32,32,32, 32,32
3C	21552 DATA 32,32,32,32,32,32, 32,93	41	22136 DATA 32,32,32,32,32,32, 32,32	D2	22232 DATA 32,32,32,32,32,32, 32,112
4C	21560 DATA 144,129,135,133,1 60,178,93,32	89	22144 DATA 32,32,32,32,32,32, 32,32	DD	22240 DATA 64,64,114,64,64,1 14,64,64
4B	21568 DATA 32,32,32,32,32,32, 32,32	D1	22152 DATA 32,32,32,32,32,32, 32,32	1F	22248 DATA 114,64,64,114,64, 64,114,64
13	21576 DATA 32,32,32,32,32,32, 32,32	99	22160 DATA 32,32,32,32,32,32, 32,32	BD	22256 DATA 64,114,64,64,114, 64,64,110
62	21584 DATA 109,64,64,64,64,6 4,125,32	61	22168 DATA 32,32,32,32,32,32, 32,32	86	22264 DATA 32,112,64,110,32, 32,32,32
F8	21592 DATA 32,32,32,32,32,32, 32,109	AS	22176 DATA 32,32,32,32,32,32, 32,32	7B	22272 DATA 32,32,32,32,32,32, 32,93
8C	21600 DATA 64,64,64,64,64,64, 125,32	F1	22184 DATA 32,32,32,32,32,32, 32,32	E9	22280 DATA 32,48,93,32,49,93, 32,50
33	21608 DATA 32,32,32,32,32,32, 32,32	89	22192 DATA 32,32,32,32,32,32, 32,32	E2	22288 DATA 93,32,51,93,32,52, 93,32
7B	21616 DATA 32,32,32,32,32,32, 32,32	81	22200 DATA 32,32,32,32,32,32, 32,32	B9	22296 DATA 53,93,32,54,93,32, 55,93
C3	21624 DATA 32,32,32,32,32,32, 32,32	C9	22208 DATA 32,32,32,32,32,32, 32,32	E1	22304 DATA 32,93,131,93,32,3 15,12
8B	21632 DATA 32,32,32,32,32,32, 32,32	11	22216 DATA 32,32,32,32,32,32, 114,64,110	62	22312 DATA 15,21,18,32,32,45 96,107
53	21640 DATA 32,32,32,32,32,32, 32,32	B3	21736 DATA 32,32,32,32,32,32, 32,32	C2	22320 DATA 64,64,91,64,64,91 64,64
9B	21648 DATA 32,32,32,32,32,32, 32,32	F3	21744 DATA 32,112,64,110,32, 13,21,12	02	22328 DATA 91,64,64,91,64,64 91,64
E3	21656 DATA 32,32,32,32,32,32, 32,32	D1	21752 DATA 20,9,32,32,32,32, 32,93	01	22336 DATA 64,91,64,64,91,64 64,115
AB	21664 DATA 32,32,32,32,32,32, 32,32	36	21760 DATA 48,93,49,93,50,93, 51,93	B7	22344 DATA 32,109,64,125,32, 32,32,32
73	21672 DATA 32,32,32,32,32,32, 32,32	58	21768 DATA 52,93,53,93,54,93, 55,93	4B	22352 DATA 32,32,32,32,32,32, 32,93
8B	21680 DATA 32,32,32,32,32,32, 32,32	D2	21776 DATA 32,32,32,32,32,32, 32,32	C6	22360 DATA 48,48,93,48,48,93 48,48
03	21688 DATA 32,32,32,32,32,32, 32,32	D9	21784 DATA 32,93,141,93,32,3 2,32,32	7E	22368 DATA 93,48,48,93,48,48 93,48
CB	21696 DATA 32,32,32,32,32,32, 32,32	37	21792 DATA 32,32,32,32,32,45 32,107	CB	22376 DATA 48,93,48,48,93,48 48,93
93	21704 DATA 32,32,32,32,32,32, 32,32	52	21800 DATA 67,91,67,91,67,91 67,91	60	22384 DATA 32,32,32,32,32,32, 32,32
08	21712 DATA 32,32,32,32,32,32, 32,112	27	21808 DATA 64,91,64,91,64,91 64,115	C1	22392 DATA 32,32,32,32,32,32, 32,109
9B	21720 DATA 64,114,64,114,64, 114,64,114	3A	21816 DATA 32,32,32,32,32,32, 32,32	FA	22400 DATA 64,64,113,64,64,1 13,64,64
47	21728 DATA 64,114,64,114,64, 114,64,114	72	21824 DATA 32,109,64,125,32, 3,15,12	69	22408 DATA 113,64,64,113,64, 64,113,64
DA	21736 DATA 32,32,32,32,32,32, 32,32	D8	21832 DATA 15,21,18,32,32,32, 32,93	FA	22416 DATA 64,113,64,64,113, 64,64,125
E2	21744 DATA 32,32,32,32,32,32, 32,32	0A	21840 DATA 48,93,48,93,48,93 48,93	AB	22424 DATA 32,32,32,32,32,32, 32,32
EA	21752 DATA 32,32,32,32,32,32, 32,32	92	21848 DATA 48,93,48,93,48,93 48,93	9E	22432 DATA 32,32,32,32,32,32, 32,96
B2	22000 DATA 32,32,32,32,32,32, 32,32	62	21856 DATA 32,32,32,32,32,32, 32,32	BB	22440 DATA 32,32,32,32,32,32, 32,32
FA	22008 DATA 32,32,32,32,32,32, 32,32	6A	21864 DATA 32,32,32,32,32,32, 32,32		
09	22016 DATA 32,32,32,32,32,32, 32,32				



# LISTINGS

AO	22448 DATA 32,32,32,32,32,32,32,32	A4	22784 DATA 64,64,64,110,112,64,64,64	EB	110,112,64
CB	22456 DATA 32,32,32,32,32,32,32,32	DA	22792 DATA 110,112,64,64,64,110,112,64	EB	23120 DATA 64,64,110,112,64,64,64,110
EB	22464 DATA 32,134,177,32,45,32,14,5	DE	22800 DATA 64,64,110,112,64,64,64,110	57	23128 DATA 93,49,54,48,93,93,49,54
D2	22472 DATA 24,20,32,16,1,7,5,32	26	22808 DATA 93,32,48,32,93,93,32,49	AD	23136 DATA 48,93,93,49,54,48,93,93
29	22480 DATA 32,32,32,32,134,179,32,45	6E	22816 DATA 32,93,93,32,50,32,93,93	25	23144 DATA 49,54,48,93,93,49,54,48
70	22488 DATA 32,16,18,5,22,9,15,21	89	22824 DATA 32,51,32,93,93,32,52,32	32	23152 DATA 93,93,49,54,48,93,93,49
2F	22496 DATA 19,32,16,1,7,5,32,32	07	22832 DATA 93,93,32,53,32,93,93,32	DA	23160 DATA 54,48,93,93,49,54,48,93
90	22504 DATA 0,0,0,0,0,0,0,0	26	22840 DATA 54,32,93,93,32,55,32,93	D5	23168 DATA 109,64,64,64,125,109,64,64
EO	22512 DATA 32,32,32,32,32,32,32,32	C2	22848 DATA 109,64,64,64,125,109,64,64	49	23176 DATA 64,125,109,64,64,64,125,109
B0	22520 DATA 32,32,32,32,32,32,32,112,64	6A	22856 DATA 64,125,109,64,64,64,125,109	1F	23184 DATA 64,64,64,125,109,64,64,64
B6	22528 DATA 112,64,64,64,64,64,64,110,32	74	22864 DATA 64,64,64,125,109,64,64,64	09	23192 DATA 125,109,64,64,64,125,109,64
04	22536 DATA 32,32,32,32,32,32,32,112	72	22872 DATA 125,109,64,64,64,125,109,64	D9	23200 DATA 64,64,125,109,64,64,64,125
2E	22544 DATA 64,64,64,64,64,64,64,110,32	3E	22880 DATA 64,64,125,109,64,64,64,125	D5	23208 DATA 64,64,64,64,64,64,64,64
67	22552 DATA 32,32,32,32,32,32,32,32	1E	22888 DATA 112,64,64,64,110,112,64,64	1D	23216 DATA 64,64,64,64,64,64,64,64
2A	22560 DATA 62,32,32,32,32,32,32,32	6A	22896 DATA 64,110,112,64,64,64,110,112	65	23224 DATA 64,64,64,64,64,64,64,64
FO	22568 DATA 93,144,47,131,47,130,93,32	EC	22904 DATA 64,64,64,110,112,64,64,64	AD	23232 DATA 64,64,64,64,64,64,64,64
20	22576 DATA 32,32,32,32,32,32,32,32	52	22912 DATA 110,112,64,64,64,110,112,64	F5	23240 DATA 64,64,64,64,64,64,64,64
11	22584 DATA 144,129,135,133,160,179,93,32	06	22920 DATA 64,64,110,112,64,64,64,110	CE	23248 DATA 32,32,32,32,32,32,32,112
4F	22592 DATA 32,32,32,32,32,32,32,32	39	22928 DATA 93,32,32,32,93,93,32,32	33	23256 DATA 64,110,32,32,32,32,32,32
17	22600 DATA 32,32,32,32,32,32,32,32	AA	22936 DATA 32,93,93,32,32,32,93,93	2D	23264 DATA 32,32,32,32,32,32,32,32
OE	22608 DATA 109,64,64,64,64,64,64,125,32	A2	22944 DATA 32,32,32,93,93,32,32,32	F5	23272 DATA 32,32,32,32,32,32,32,32
DC	22616 DATA 32,32,32,32,32,32,32,109	66	22952 DATA 93,93,32,32,32,93,93,32	BD	23280 DATA 32,32,32,32,32,32,32,32
60	22624 DATA 64,64,64,64,64,64,64,125,32	15	22960 DATA 32,32,93,93,32,32,32,93	OE	23288 DATA 32,32,32,32,32,32,32,32
37	22632 DATA 32,32,32,32,32,32,32,32	A1	22968 DATA 93,32,32,32,93,93,32,32	8D	23296 DATA 144,93,32,45,32,16,12,1
7F	22640 DATA 32,32,32,32,32,32,32,32	52	22976 DATA 32,93,93,32,32,32,93,93	20	23304 DATA 3,5,32,19,16,18,9,20
CB	22648 DATA 32,112,64,110,32,32,32,32	9A	22984 DATA 32,32,32,93,93,32,32,32	AO	23312 DATA 5,32,15,14,32,19,3,18
8F	22656 DATA 32,32,32,32,32,32,32,32	4E	22992 DATA 93,93,32,32,32,93,93,32	FA	23320 DATA 5,5,14,32,32,32,32,32
57	22664 DATA 32,32,32,32,32,32,32,32	OD	23000 DATA 32,32,93,93,32,32,32,93	OD	23328 DATA 32,32,32,32,32,32,32,32
9F	22672 DATA 32,32,32,32,32,32,32,32	C9	23008 DATA 93,32,32,32,93,93,32,32	46	23336 DATA 64,125,32,32,32,32,32,32
E7	22680 DATA 32,32,32,32,32,32,32,32	FA	23016 DATA 32,93,93,32,32,32,93,93	64	23344 DATA 32,32,32,32,32,32,32,32
D3	22688 DATA 32,93,130,93,32,45,32,19	B2	23024 DATA 32,32,32,93,93,32,32,32	4C	23352 DATA 32,32,32,32,32,32,32,32
B9	22696 DATA 16,18,9,20,5,32,4,1	F6	23032 DATA 93,93,32,32,32,93,93,32	F4	23360 DATA 32,32,32,32,32,32,32,32
C2	22704 DATA 20,1,32,16,15,9,14,20	88	23040 DATA 32,32,93,93,32,32,32,93	8F	23368 DATA 32,32,32,32,32,32,32,32
CE	22712 DATA 5,18,19,32,40,49,54,48	6D	23048 DATA 109,64,64,64,125,109,64,64	F2	23376 DATA 64,110,32,32,32,32,32,32
B5	22720 DATA 45,50,53,53,41,32,32,32	01	23056 DATA 64,125,109,64,64,64,125,109	6C	23384 DATA 32,32,32,32,32,32,32,32
4C	22728 DATA 32,109,64,125,32,32,32,32	F7	23064 DATA 64,64,64,125,109,64,64,64	1C	23392 DATA 32,32,32,32,32,32,32,32
DF	22736 DATA 32,32,32,32,32,32,32,32	C1	23072 DATA 125,109,64,64,64,125,109,64	7C	23400 DATA 32,32,32,32,32,32,32,32
27	22744 DATA 32,32,32,32,32,32,32,32	E1	23080 DATA 64,64,125,109,64,64,64,125	AF	23408 DATA 32,32,32,32,32,32,32,32
EF	22752 DATA 32,32,32,32,32,32,32,32	67	23088 DATA 112,64,64,64,110,112,64,64	65	23416 DATA 131,93,32,45,32,3,18,5
B7	22760 DATA 32,32,32,32,32,32,32,32	FD	23096 DATA 64,110,112,64,64,64,110,112	78	23424 DATA 1,20,5,32,13,47,3,15
01	22768 DATA 112,64,64,64,110,112,64,64	13	23104 DATA 64,64,64,110,112,64,64,64	B4	23432 DATA 4,5,32,16,18,15,7,18
3B	22776 DATA 64,110,112,64,64,64,110,112	QD	23112 DATA 110,112,64,64,64,110,112,64	61	23440 DATA 1,13,32,32,32,32,32,32
				E5	23448 DATA 32,32,32,32,32,32,32,32



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,32,109
CO 23456 DATA 64,125,96,32,32,3
2,32,32
BC 23464 DATA 32,32,32,32,32,32
,32,32
EA 23472 DATA 32,32,32,32,32,32
,32,96
CC 23480 DATA 32,32,32,32,32,32
,32,32
7F 23488 DATA 32,134,179,32,45,
32,16,18
95 23496 DATA 5,22,9,15,21,19,3
2,16
96 23504 DATA 1,7,5,32,32,32,32
,32
EC 23512 DATA 32,32,32,32,32,32
,32,32
94 23520 DATA 32,32,32,32,32,32
,32,32
35 23528 DATA 32,109,64,125,96,
32,32,32
24 23536 DATA 32,32,32,32,32,32
,32,32
OC 23544 DATA 32,32,32,32,32,32
,32,32
45 23552 DATA 81,0,144,80,0,0,0
,88
33 23560 DATA 0,132,0,0,0,0,77,
48
86 23568 DATA 0,0,0,0,0,77,49,0
18 23576 DATA 0,0,0,0,85,83,0,0
6D 23584 DATA 0,0,0,80,71,129,0
,0
88 23592 DATA 0,0,70,73,0,0,0,0
F1 23600 DATA 0,89,0,133,0,0,0,
0
5E 23608 DATA 65,0,134,64,0,0,0
,66
C6 23616 DATA 0,134,64,0,0,0,67
,0
DE 23624 DATA 134,64,0,0,0,65,1
28,1
C5 23632 DATA 221,159,0,0,68,0,
132,0
55 23640 DATA 0,0,0,73,0,132,0,
0
D4 23648 DATA 0,0,66,65,0,0,0,0
8D 23656 DATA 0,67,79,87,0,1,0,
16
97 23664 DATA 129,0,0,0,0,129,0
,0
1F 23672 DATA 0,0,129,0,0,0,0,1
29
7D 23680 DATA 0,0,0,0,129,0,0,0
DF 23688 DATA 0,129,0,0,0,0,129
,0
4D 23696 DATA 0,0,0,129,0,0,0,0
CB 23704 DATA 0,0,0,0,0,0,0,0
53 23712 DATA 0,0,0,0,0,0,0,0
5B 23720 DATA 0,0,0,0,0,0,0,0
63 23728 DATA 0,0,0,0,0,0,0,0
EB 23736 DATA 0,0,0,0,0,0,0,0
CC 23744 DATA 66,0,62,0,1,0,11,
136
E3 23752 DATA 32,0,0,0,136,32,0
,0
CB 23760 DATA 0,136,32,0,0,0,13
6,32
FA 23768 DATA 0,0,0,136,32,0,0,
0
2B 23776 DATA 136,32,0,0,0,136,
32,0
E2 23784 DATA 0,0,136,32,0,0,0,
0
A3 23792 DATA 0,0,0,0,0,0,0,0
A7 23800 DATA 0,0,0,0,0,0,69,0,
256

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## PROGRAM: SPRITE PROGRAMMER

```

48 10 L=L+1:IF L=1 THEN LOAD"SP.CO
DE",8,1
CF 100 POKE198,0:PRINTCHR$(8):Q
=53248
CO 110 PRINT"[CLR,WHITE]":POKE5
3281,11:POKE53280,11:POKE250
,0
49 120 SYS16384:SYS17016:FORX=0
TO5:POKE16554+X,0:NEXT
86 130 PRINT"[UP2,C8,SPC9,CA,S*
30,CS]"
95 140 PRINT"[SPC4,S-,RIGHT30,S
-]"
78 150 PRINT"[SPC4,C2,S*30,CX]"
EE 160 PRINT"[YELLOW,DOWN2,RIGH
T13,SPC5,CA,S*,CR,S*,CR,S*,C
R,S*,CR,S*,CR,S*,CR,S*,CR,S*
,CS]"
00 170 PRINT"[SPC5,C6]SPRITE NO
-> [YELLOW,S-]0[S-]1[S-]2[S-]
3[S-]4[S-]5[S-]6[S-]7[S-]"
6E 180 PRINT"[SPC18,CQ,S*,S*,S*
,S*,S*,S*,S*,S*,S*,S*,S*,S*
,S*,S*,S*,CW]"
98 190 PRINT"[SPC5,C6]0=OFF/1=O
N-> [YELLOW,S-]0[S-]1[S-]2[S-]
3[S-]4[S-]5[S-]6[S-]7[S-]"
F4 200 PRINT"[SPC18,C2,S*,CE,S*
,CE,S*,CE,S*,CE,S*,CE,S*,CE,
S*,CE,S*,CX]"
A1 210 PRINT"[DOWN2,WHITE]F2[YE
LOW]-CHANGE BORDER[SPC3,WHI
TE]F4[YELLOW]-CHANGE BACKGRO
UND"
F7 220 PRINT"[WHITE,DOWN3,RIGHT
6,RVSON][RVSONOFF][C6]PRESS
ANY KEY TO CONTINUE [WHITE,R
VSON][RVSONOFF]":
C7 230 WAIT198,1:POKE198,0:M0=0
:M1=0
BF 240 DIM CO(15):US=0:PG=1:SYS
16580
36 250 FORX=0TO7:B(X)=160:CO(X)
=1:NEXT
73 260 POKEQ+21,0:POKE53285,M0:
POKE53286,M1:FI=0:PRINT"[WHI
TE]"
D6 270 IFPG=1 THEN SYS16448:SYS16
704:SYS16746:POKE56138,13:GO
TO300
79 280 IFPG=2 THEN SYS16481:SYS16
704:SYS16746:POKE56098,13:GO
TO920
64 290 IFPG=3 THEN SYS16514:SYS16
704:POKE55458,13:POKE56064,1
3:POKE56184,13:GOTO1100
14 300 GOSUB620
11 310 GETAS:IFAS="" THEN SYS1666
1:GOTO310
2A 320 IFAS="E" THEN 380
66 330 IFAS="X" THEN 440
8E 340 IFAS="Y" THEN 490
23 350 IFAS="[F1]" THEN PG=PG+1:G
OTO260
19 360 IFAS="[F7]" THEN 1880
4C 370 GOTO310
41 380 GOSUB540
36 390 V=A-48:W=E(U):POKE16551,
W
37 400 SYS16756:A=PEEK(16552)
8C 410 E(U)=A:GOTO300
03 420 SYS16756:A=PEEK(16552)
FO 430 E(U)=A:GOTO300
F6 440 GOSUB540:V=A-48:W=XE(U):
POKE16551,W
4D 450 SYS16756:A=PEEK(16552)
38 460 XE(U)=A:GOTO300

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39 470 SYS16756:A=PEEK(16552)
OC 480 XE(U)=A:GOTO300
EF 490 GOSUB540:V=A-48:W=Y(U):
POKE16551,W
73 500 SYS16756:A=PEEK(16552)
E7 510 YE(U)=A:GOTO300
AE 520 SYS16756:A=PEEK(16552)
CO 530 YE(U)=A:GOTO300
BB 540 SYS16400
9F 550 AS="" :SYS16661
55 560 GETAS:IFAS="" THEN 550
53 570 IFASC(AS)<48 OR ASC(AS)>
55 THEN 560
56 580 A=ASC(AS):POKE1063-6,A
9D 590 POKE16549,A
7D 600 PRINT"[HOME]"TAB(27)"[SP
C5]>[SPC3]"
EA 610 RETURN
CD 620 X=0:Y=0
BD 630 A=E(X):A=A+48:B=XE(X):B=
B+48:C=Y(U):C=C+48
53 640 POKE1360+Y,A:POKE1640+Y,
B:POKE1920+Y,C
9D 650 X=X+1:Y=Y+2
E4 660 IFY=16 THEN RETURN
9C 670 GOTO630
EO 680 X=0:Y=0:Z=16
F6 690 A=MC(X):A=A+48
6D 700 POKE1360+Y,A
29 710 X=X+1:Y=Y+2
FE 720 IFY=16 THEN 750
E2 730 GOTO690
14 740 SYS16661
04 750 POKE1600,US+48
BB 760 X=0:Y=0:Z=0
6C 770 B=CO(X):B=B+48:IFB=>58TH
EN820
36 780 Z=1
E1 790 POKE1880+Y+Z,B:Y=Y+3:M=X
=X+1:N=0:Z=0:
ED 800 IFX=8 THEN 880
1C 810 GOTO770
02 820 AS=STR$(B-48)
55 830 CS=LEFT$(AS,2):B=VAL(CS)
:B=B+48
AC 840 POKE1880+Y,B:CS=MID$(AS,
3):B=VAL(CS):B=B+48:N=1
3D 850 POKE1880+Y+1-Z,B:Y=Y+3:Z
=0
7A 860 X=X+1:IFX=8 THEN 880
50 870 GOTO770
00 880 X=0:Y=0
9D 890 A=MC(X):A=A+48:POKE1360+
Y,A:X=X+1:Y=Y+2
68 900 IFY=16 THEN RETURN
99 910 GOTO890
A4 920 GOSUB680
B7 930 GETAS:IFAS="" THEN SYS1666
1:GOTO930
63 940 IFAS="M" THEN 1010
CD 950 IFAS="U" THEN 1050
OE 960 IFAS="C" THEN 1060
31 970 IFAS="[F1]" THEN PG=PG+1:G
OTO260
BB 980 IFAS="[F3]" THEN PG=PG+1:G
OTO260
71 990 IFAS="[F7]" THEN 1880
DB 1000 GOTO930
C9 1010 GOSUB540
2B 1020 V=A-48:W=MC(U):POKE1655
1,W
AE 1030 SYS16756:A=PEEK(16552)
E2 1040 MC(U)=A:GOTO920
CF 1050 GOSUB540:US=A-48:POKE16
00,A:GOTO920
EE 1060 GOSUB540:V=A-48
FC 1070 INPUT"[HOME,RIGHT27]0-1
5 ";CV
20 1080 IF CV<0 OR CV>15 THEN 10
70
96 1090 CO(U)=CV:GOSUB600:GOTO2
60
48 1100 REM ** PAGE III **
38 1110 FORX=0TO7:POKE2040+X,B(

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# LISTINGS

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X):NEXT:GOSUB1200
74 1120 GETA$:IFAS$=" "THEN SYS166
61:GOTO1120
28 1130 IFAS$="P"AND E1>0 THEN 1280

2D 1140 IFAS$="C"THEN 2070
8C 1150 IFAS$="B"THEN 1330
65 1160 IFAS$="U"THEN GOSUB 540:US
-A-48:GOTO260
46 1170 IFAS$="[F3]"THEN PG-PG-1:
GOTO260
58 1180 IFAS$="[F7]"THEN 1880
A7 1190 GOTO1120
C8 1200 PRINT"[HOME,DOWN19]"TAB
(25)US"[LEFT] ON SCREEN"
6A 1210 PRINT"[HOME,DOWN15]"B(0
);B(1);B(2);B(3);B(4);B(5);B
(6);B(7)
B3 1220 PRINT"[UP2,S-,RIGHT4,S-
,RIGHT4,S-,RIGHT4,S-,RIGHT4,
S-,RIGHT4,S-,RIGHT4,S-,RIGHT
4,S-]"
EB 1230 GOSUB1380
4F 1240 POKE53271,0:POKE53277,0
:X=0:GOSUB1490
45 1250 POKE53276,MC1
9A 1260 POKEQ+39+X,CO(X):X=X+1:
IFX<-7 THEN 1250
FF 1270 SYS16768:POKEQ+21,E1:RE
TURN
FB 1280 POKEQ+21,0:PRINT"[CLR]"
:GOSUB1590:GOSUB1590:POKEQ+1
6,0
92 1290 T=PEEK(53280):T1=PEEK(5
3281):POKE53277,XE1:POKE5327
1,YE1
D9 1300 POKE53280,R:POKE53281,R
1:GOSUB1780:POKE16557,X
99 1310 POKE16554,US:POKE251,US
:POKEQ+21,E1:SYS16837:R=PEEK
(53280)
5F 1320 R1=PEEK(53281):POKE5328
0,T:POKE53281,T1:GOTO260
29 1330 GOSUB 540:U-A-48
53 1340 INPUT"[HOME,RIGHT24]160
-255 ";CV
34 1350 IF CV<160 OR CV>255 THEN
1340
35 1360 B(U)=CV
CO 1370 FORX=0 TO 7:POKE2040+X,B(
X):NEXT:GOTO260
E6 1380 REM
05 1390 E1=0
A1 1400 IFE(0)=1 THEN E1=1
5F 1410 IFE(1)=1 THEN E1=E1+2
A4 1420 IFE(2)=1 THEN E1=E1+4
3F 1430 IFE(3)=1 THEN E1=E1+8
F9 1440 IFE(4)=1 THEN E1=E1+16
44 1450 IFE(5)=1 THEN E1=E1+32
06 1460 IFE(6)=1 THEN E1=E1+64
C4 1470 IFE(7)=1 THEN E1=E1+128
43 1480 RETURN
9F 1490 MC=0
63 1500 IFMC(0)=1 THEN MC1=1
06 1510 IFMC(1)=1 THEN MC1=MC1+2
31 1520 IFMC(2)=1 THEN MC1=MC1+4
D6 1530 IFMC(3)=1 THEN MC1=MC1+8
11 1540 IFMC(4)=1 THEN MC1=MC1+16

22 1550 IFMC(5)=1 THEN MC1=MC1+32
86 1560 IFMC(6)=1 THEN MC1=MC1+64
C2 1570 IFMC(7)=1 THEN MC1=MC1+12
8
BC 1580 RETURN
4B 1590 XE=0
0E 1600 IFXE(0)=1 THEN XE1=1
06 1610 IFXE(1)=1 THEN XE1=XE1+2
35 1620 IFXE(2)=1 THEN XE1=XE1+4
A6 1630 IFXE(3)=1 THEN XE1=XE1+8
36 1640 IFXE(4)=1 THEN XE1=XE1+16
21 1650 IFXE(5)=1 THEN XE1=XE1+32
37 1660 IFXE(6)=1 THEN XE1=XE1+64
59 1670 IFXE(7)=1 THEN XE1=XE1+12
8
D6 1680 YE=0
EA 1690 IFYE(0)=1 THEN YE1=1
7F 1700 IFYE(1)=1 THEN YE1=YE1+2
BC 1710 IFYE(2)=1 THEN YE1=YE1+4
DF 1720 IFYE(3)=1 THEN YE1=YE1+8
B1 1730 IFYE(4)=1 THEN YE1=YE1+16
5E 1740 IFYE(5)=1 THEN YE1=YE1+32
5E 1750 IFYE(6)=1 THEN YE1=YE1+64
36 1760 IFYE(7)=1 THEN YE1=YE1+12
8
7E 1770 RETURN
C9 1780 IFUS=0 THEN X=1
6B 1790 IFUS=1 THEN X=2
AB 1800 IFUS=2 THEN X=4
6E 1810 IFUS=3 THEN X=8
9A 1820 IFUS=4 THEN X=16
03 1840 IFUS=5 THEN X=32
13 1850 IFUS=6 THEN X=64
3B 1860 IFUS=7 THEN X=128
DB 1870 RETURN
DO 1880 REM
43 1890 POKEQ+21,0:SYS17744
31 1900 PRINT"[HOME,DOWN10]"TAB
(29)MO
71 1910 PRINT"[HOME,DOWN13]"TAB
(29)M1
28 1920 GETA$:IFAS$=" "THEN 1920
55 1930 IFAS$="S"THEN 2750
9E 1940 IFAS$="L"THEN 2600
07 1950 IFAS$="D"THEN SYS17509:WA
IT198,1:GOTO1880
A5 1960 IFAS$="O"AND MO<16 THEN MO=
MO+1
80 1970 IFAS$="M"THEN 2030
51 1980 IFAS$="1"AND M1<16 THEN M1=
M1+1
DC 1990 IFAS$="[F7]"THEN 260
36 2000 IFMO=16 THEN MO=0
86 2010 IFM1=16 THEN M1=0
D4 2020 GOTO1890
86 2030 D=8:INPUT"[CLR,DOWN2,RI
GHT3]ENTER DEVICE [RVSON,C6]
1[WHITE,RVSOFF]=TAPE / [RVSO
N,C6]8[WHITE,RVSOFF]=DISK";D
A9 2040 PRINT"[DOWN]ENTER FILEN
AME : ";
62 2050 POKE253,D:SYS17184:SYS1
7440:SYS16580
5A 2060 SYS17631:WAIT198,1:GOTO
260
91 2070 REM
FE 2080 SA=49152:POKEQ+21,0
95 2090 PRINT"[CLR,DOWN2,YELLOW
] ENTER START ADDRESS (RETUR
N = 49152)"
94 2100 INPUT"[DOWN,RIGHT]";SA
AF 2110 IFSA<12288 OR SA>52992
THEN 2090
14 2120 EA=0
OA 2130 GOSUB1380:IFE1=0 THEN GOT
0260
AD 2140 PRINT"[DOWN,RIGHT3,WHIT
E,RVSON]PLEASE WAIT WHILE CR
EATING PROGRAM"
2B 2150 POKESA+EA,169:EA=EA+1:P
OKESA+EA,E1
03 2160 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,21:EA=EA+1:
POKESA+EA,208
82 2170 GOSUB1490:IFMC1=0 THEN 22
00
49 2180 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,MC1
DB 2190 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,28:EA=EA+1:
POKESA+EA,208
4F 2200 GOSUB1590:IFXE1=0 THEN 22
30
C2 2210 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,XE1
AF 2220 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,29:EA=EA+1:
POKESA+EA,208
5F 2230 IFYE1=0 THEN 2260
43 2240 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,YE1
27 2250 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,23:EA=EA+1:
POKESA+EA,208
D4 2260 IFMC=0 THEN 2310
CF 2270 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,MO
22 2280 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,37:EA=EA+1:
POKESA+EA,208
DC 2290 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,M1
5F 2300 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,38:EA=EA+1:
POKESA+EA,208
CF 2310 A=PEEK(250):EA=EA+1:POK
ESA+EA,169:EA=EA+1:POKESA+EA
,A
CE 2320 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,16:EA=EA+1:
POKESA+EA,208
DA 2330 A=17408:FORX=0 TO 7:IFE(X
)=0 THEN NEXT
A5 2340 IFX=8 THEN 2440
F6 2350 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,CO(X)
D9 2360 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,39+X:EA=EA+
1:POKESA+EA,208
A1 2370 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,PEEK(A+X*2)
B9 2380 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,X*2:EA=EA+1
:POKESA+EA,208
04 2390 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,PEEK(A+1+X*
2)
06 2400 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,1+X*2:EA=EA
+1:POKESA+EA,208
76 2410 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,B(X)
08 2420 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,248+X:EA=EA
+1:POKESA+EA,7
05 2430 NEXT
A7 2440 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,R
92 2450 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,32:EA=EA+1:
POKESA+EA,208
DC 2460 EA=EA+1:POKESA+EA,169:E
A=EA+1:POKESA+EA,R1
5F 2470 EA=EA+1:POKESA+EA,141:E
A=EA+1:POKESA+EA,33:EA=EA+1:
POKESA+EA,208
DB 2480 EA=EA+1:POKESA+EA,96
DB 2490 PRINT"[DOWN2]PROGRAM CR
EATED"
73 2500 PRINT"[DOWN]START ADDRE
SS:[RVSON]"SA
9A 2510 PRINT"[DOWN]END ADDRESS
:[RVSON]"SA+EA
94 2520 D=8:INPUT"[DOWN,RIGHT]C
1]=TAPE / [C8]=DISK (RETURN =
8)";D
BB 2530 IFD<>8 AND D<>1 THEN 251
0
AO 2540 PRINT"[DOWN,RIGHT]SAVE
TO DEVICE"D"UNDER THE FILENA

```



```

ME..."
E4 2550 INPUTFS
OD 2560 IFLEN(F$)>16THENPRINT"C
UP21":GOTO2540
70 2570 SYS17127,"@:"+F$,D,1,S
A,SA+EA+1:SYS17631
46 2580 POKE198,0:PRINT"[DOWN]S
AUED. SYS"SA"TO RUN CREATED
FILE":WAIT198,1
15 2590 GOTO260
ED 2600 REM
A6 2610 PRINT"[CLR,DOWN2,RIGHTS
]LOAD VARIABLES":D=8
E5 2620 INPUT "[DOWN2] [B]-DISK
/[1]-TAPE";D
BB 2630 INPUT"[DOWN2] ENTER FIL
ENAME";F$
45 2640 IFD=8THENOPEN1,8,2,"@:
"+F$+"S,R":SYS17631
9A 2650 IFD=1THENOPEN1,1,0,F$:S
YS17631
B4 2660 INPUT#1,M0
7F 2670 INPUT#1,M1
DO 2680 INPUT#1,MSB,R,R1
E7 2690 FORI=0TO7
OD 2700 INPUT#1,E(I),MC(I),XE(I
),YE(I),CO(I),B(I),PO(I),PI(I
)
CO 2710 NEXTI:CLOSE1
1F 2720 FORX=0TO7:POKE17408+X,P
O(X):POKE17416+X,P1(X):NEXT:
POKE250,MSB
B9 2730 GOTO260
31 2740 REM
EB 2750 FORX=0TO7:PO(X)=PEEK(17
408+X):P1(X)=PEEK(17416+X):N
EXT:MSB=PEEK(250)
7A 2760 PRINT"[CLR,DOWN2,RIGHT4
]SAVE VARIABLES":D=8
C3 2770 INPUT "[DOWN2] [B]-DISK
/[1]-TAPE";D
C1 2780 INPUT"[DOWN2] ENTER FIL
ENAME";F$
2D 2790 IFD=8THENOPEN2,8,2,"@:
"+F$+"S,W":SYS17631
92 2800 IFD=1THENOPEN2,1,1,F$:S
YS17631
1F 2810 PRINT#2,M0
03 2820 PRINT#2,M1
19 2830 PRINT#2,MSB;CHR$(13);R;
CHR$(13);R1;CHR$(13)
64 2840 FORI=0TO7
B9 2850 PRINT#2,E(I);CHR$(13);M
C(I);CHR$(13);XE(I);CHR$(13)
;YE(I);CHR$(13);
A1 2860 PRINT#2,CO(I);CHR$(13);
B(I);CHR$(13);PO(I);CHR$(13)
;P1(I);CHR$(13);
E4 2870 NEXTI:CLOSE2
F2 2880 GOTO260

```

## Graphic Editor



PROGRAM: CHAR ED LOAD

```

EC 1 REM ** THIS PROGRAM IS USE
D TO **
03 2 REM ** CREATE A COPY OF TH
E **
43 3 REM ** CHAR EDITOR ON YOUR
OWN **
9D 4 REM ** TAPE OR DISK
**
E9 10 BL=337:LN=50:SA=28672
60 20 FOR L=0 TO BL:CX=0:FOR D=

```

```

0 TO 15:READA:CX=CX+A
B7 30 POKE53280,A:POKE SA+L*16+
D,A:NEXT D
73 40 READ A:IF A<CX THENPRINT
"ERROR IN LINE";LN+(L*10):ST
OP
FE 45 NEXT L:SYS 33904
BB 50 DATA 34,8,195,7,158,50,48
,56,48,58,143,34,20,20,20,20
,919
91 60 DATA 82,65,84,84,0,0,0,0,
0,0,0,0,0,0,162,477
74 70 DATA 0,189,57,8,157,0,1,2
32,224,161,208,245,162,13,18
9,222,2078
7C 80 DATA 8,149,234,202,16,248
,120,165,1,133,237,160,0,132
,1,76,1882
18 90 DATA 0,1,177,244,145,238,
230,238,208,2,230,239,230,24
4,208,2,2636
53 100 DATA 230,245,165,239,197
,243,144,234,208,6,165,238,1
97,242,144,225,3123
BB 110 DATA 177,242,145,240,199
,240,165,240,201,255,208,2,1
98,241,199,242,3192
1F 120 DATA 165,242,201,255,208
,2,199,243,165,243,201,8,176
,226,165,240,2938
79 130 DATA 24,105,2,133,240,20
8,2,230,237,160,0,177,240,18
7,236,240,2431
FB 140 DATA 39,238,0,4,145,234,
230,234,208,2,230,235,230,24
0,208,2,2479
BC 150 DATA 230,241,165,241,197
,247,144,225,208,6,165,240,1
97,246,144,217,3113
C2 160 DATA 165,237,133,1,88,76
,32,8,160,2,177,240,170,136,
177,240,2042
C0 170 DATA 136,145,234,72,230,
234,208,2,230,235,104,202,20
8,243,165,240,2898
B7 180 DATA 24,105,3,133,240,14
4,178,230,241,165,0,240,172,
1,8,51,1939
DC 190 DATA 0,1,8,242,29,132,27
,235,8,242,29,22,8,195,7,158
,1344
69 200 DATA 50,48,55,48,58,143,
34,51,20,4,82,65,84,84,51,0,
878
AB 210 DATA 11,162,0,189,115,8,
157,0,1,232,224,147,208,245,
162,0,1861
3C 220 DATA 189,10,9,157,0,2,23
2,224,84,208,245,169,62,133,
252,169,2145
A2 230 DATA 3,133,253,173,6,9,1
33,250,173,7,9,133,251,173,8
,9,1723
E3 240 DATA 133,249,173,9,9,133
,249,165,248,56,229,250,133,
254,165,249,2703
B7 250 DATA 229,251,133,255,165
,254,24,105,61,133,254,165,2
55,105,3,133,2525
E6 260 DATA 255,76,0,1,120,165,
1,133,247,169,0,133,1,160,0,
177,1638
BB 270 DATA 250,145,252,230,250
,208,2,230,251,230,252,208,2
,230,253,165,3158
AB 280 DATA 251,197,249,144,234
,208,6,165,250,197,248,144,2
26,162,8,189,2878
9A 290 DATA 0,2,24,125,2,2,133,
250,189,1,2,125,3,2,133,251,
1244
BE 300 DATA 165,250,56,233,1,13
3,250,165,251,233,0,133,251,
189,2,2,2314

```

```

B4 310 DATA 133,252,189,3,2,133
,253,160,0,177,254,145,250,1
65,254,56,2426
EF 320 DATA 233,1,133,254,165,2
55,233,0,133,255,165,250,56,
233,1,133,2500
FC 330 DATA 250,165,251,233,0,1
33,251,165,252,56,233,1,133,
252,165,253,2792
A7 340 DATA 233,0,133,253,5,252
,208,209,138,56,233,4,170,16
,160,165,2235
34 350 DATA 247,133,1,88,76,0,5
4,24,9,242,29,112,61,33,14,0
,1133
1A 360 DATA 98,55,1,0,112,130,5
,0,0,32,79,51,119,8,80,32,80
2
55 370 DATA 3,8,1,18,1,3,20,5,1
8,32,79,51,119,15,80,32,489
50 380 DATA 32,116,9,51,32,7,10
6,51,32,11,116,51,32,15,106,
32,799
B3 390 DATA 32,116,51,32,8,106,
51,32,4,51,48,3,51,32,4,116,
737
01 400 DATA 51,32,3,3,8,1,18,1,
3,20,5,18,51,32,3,106,355
CS 410 DATA 32,32,116,9,14,19,2
0,18,21,3,20,106,51,32,11,11
6,620
BS 420 DATA 51,32,3,51,119,9,51
,32,3,106,32,32,116,51,32,8,
728
9A 430 DATA 106,51,32,11,116,51
,32,4,5,4,9,20,15,18,51,32,5
57
BA 440 DATA 5,106,32,32,116,51,
32,8,106,51,32,11,116,51,32,
4,785
B6 450 DATA 51,119,6,51,32,5,10
6,32,32,116,3,51,32,7,106,51
,800
51 460 DATA 32,11,116,1,45,10,4
6,7,15,21,12,4,32,32,49,57,4
91
00 470 DATA 56,53,106,32,32,116
,51,32,8,106,51,32,11,116,51
,119,972
B4 480 DATA 15,106,32,32,116,3,
15,14,20,9,14,21,5,106,51,32
,591
DB 490 DATA 11,116,51,32,15,106
,32,32,76,51,111,8,122,51,32
,11,857
DA 500 DATA 76,51,111,15,122,32
,51,254,3,51,134,3,51,138,3,
51,1146
9A 510 DATA 146,3,51,162,3,51,1
94,3,51,254,3,51,0,3,51,254,
1280
0C 520 DATA 3,134,2,2,139,2,2,1
46,254,254,162,2,128,194,2,1
28,1553
59 530 DATA 51,254,3,51,0,19,25
4,254,128,134,128,128,138,12
8,128,146,1944
09 540 DATA 254,144,162,130,144
,194,130,144,51,254,3,51,0,3
,51,254,1969
BB 550 DATA 3,134,130,129,138,1
30,128,146,254,254,162,2,130
,194,2,130,2065
09 560 DATA 51,254,3,51,0,19,16
,254,254,48,2,130,16,2,130,1
6,1246
73 570 DATA 254,254,16,128,130,
16,128,130,56,254,254,51,0,3
,16,254,1944
52 580 DATA 254,48,128,134,16,1
28,138,16,254,146,16,130,162
,16,130,194,1910
35 590 DATA 56,254,254,51,0,19,
16,254,254,48,130,2,16,130,2

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# LISTINGS

,16,1502			0,173,1542			207,114,1479		
BF	600	DATA 254,254,16,2,128,16,2,128,56,254,254,51,0,3,254,254,1926	D5	890	DATA 10,96,145,42,24,173,7,96,105,1,41,1,141,7,96,96,1081	4D	1160	DATA 105,14,168,202,240,11,185,255,96,153,0,97,136,202,208,246,2318
4E	610	DATA 128,2,2,128,2,2,128,254,254,144,128,128,144,128,128,144,1844	F3	890	DATA 32,158,255,32,228,255,208,3,76,35,65,162,4,134,251,162,2061	44	1170	DATA 169,32,153,0,97,76,29,113,173,12,96,208,24,173,0,96,1450
B5	620	DATA 51,254,3,51,0,19,169,7,133,44,169,64,141,138,2,169,1414	64	900	DATA 98,134,252,174,0,98,160,0,209,251,240,18,72,24,165,251,2146	79	1180	DATA 32,70,113,160,7,56,169,255,241,253,145,253,136,16,247,32,2185
B3	630	DATA 0,133,157,169,2,141,134,2,169,2,141,32,208,169,7,141,1607	D7	910	DATA 105,3,133,251,144,2,230,252,104,202,208,236,240,210,200,177,2697	1E	1190	DATA 92,113,76,28,113,160,137,185,255,96,73,128,153,255,96,136,2096
F2	640	DATA 33,208,173,2,221,9,3,141,2,221,173,0,221,41,252,9,1709	BC	920	DATA 251,133,253,200,177,251,133,254,173,7,96,240,3,32,55,65,2323	CC	1200	DATA 208,245,76,28,113,173,22,208,73,16,141,22,208,96,160,4,1793
12	650	DATA 1,141,0,221,169,9,141,24,208,169,128,141,136,2,32,110,1632	60	930	DATA 169,69,72,169,163,7,2,108,253,0,104,104,76,209,12,173,12,1865	DA	1210	DATA 165,44,170,169,31,133,44,24,96,32,170,67,239,0,96,32,1511
11	660	DATA 75,32,228,114,160,0,185,0,63,153,0,132,200,208,247,160,1957	08	940	DATA 96,12,168,96,32,248,65,185,1,96,105,1,197,44,24,0,4,1588	9C	1220	DATA 1,66,173,5,96,208,4,24,32,21,66,138,133,44,32,92,1135
98	670	DATA 3,169,6,153,39,208,152,10,168,169,40,153,0,208,152,51,1681	D1	950	DATA 144,2,159,0,153,1,96,96,32,248,65,185,2,96,105,1,1395	6C	1230	DATA 113,76,15,114,32,170,67,206,0,96,32,35,66,176,3,32,1233
14	680	DATA 10,3,24,105,185,153,1,208,152,74,168,24,105,16,153,248,1630	B0	960	DATA 41,7,153,2,96,96,32,248,65,56,185,1,96,233,1,16,1329	B1	1240	DATA 52,66,76,199,67,173,0,96,32,70,113,169,82,133,251,169,1748
72	690	DATA 131,136,16,221,169,15,141,21,208,162,8,169,0,13,3,2,133,1665	A2	970	DATA 2,165,44,153,1,96,96,32,248,65,56,185,2,96,233,1,1475	42	1250	DATA 128,133,252,160,0,162,8,169,0,133,255,177,251,201,32,240,2301
FC	700	DATA 255,169,8,133,38,169,11,133,39,169,174,133,251,133,253,169,2237	F2	980	DATA 41,7,153,2,96,96,173,12,96,208,16,32,228,113,5,255,1533	B0	1260	DATA 3,56,208,1,24,165,255,106,133,255,165,251,105,40,133,251,2151
C9	710	DATA 130,133,252,169,218,133,254,160,0,165,255,145,251,132,40,230,2567	05	990	DATA 145,253,32,92,113,32,28,113,76,254,65,201,1,208,12,32,1657	18	1270	DATA 144,2,230,252,202,208,229,56,165,251,233,64,133,251,165,252,2836
7B	720	DATA 2,165,2,41,1,133,2,168,185,38,0,164,40,145,253,200,1539	47	1000	DATA 253,113,173,0,96,153,0,97,76,79,66,173,13,96,141,12,1541	C6	1280	DATA 233,1,133,252,200,192,9,240,9,136,165,255,145,253,200,76,2499
A4	730	DATA 230,255,192,32,208,227,24,165,251,105,40,133,251,133,253,144,2643	5D	1010	DATA 95,173,14,96,141,0,98,165,45,133,44,173,6,96,51,10,1341	9D	1290	DATA 241,67,32,92,113,76,28,113,169,6,162,12,160,0,32,8,1311
CB	740	DATA 4,230,252,230,254,230,2,202,208,205,169,112,133,251,169,61,2712	03	1020	DATA 5,109,5,96,141,0,96,32,92,113,76,15,114,173,12,96,1175	F8	1300	DATA 115,32,193,112,72,173,0,96,32,70,113,104,160,7,201,3,1483
30	750	DATA 133,252,169,40,133,253,169,128,133,254,169,255,133,38,169,62,2490	07	1030	DATA 208,15,32,228,113,56,169,255,229,255,49,253,145,253,76,76,2412	CE	1310	DATA 240,30,201,78,240,29,201,83,240,46,201,69,240,60,201,87,2246
A1	760	DATA 32,0,112,169,208,32,35,112,32,140,112,169,208,133,252,169,1915	BD	1040	DATA 66,32,253,113,169,32,153,0,97,76,79,66,173,12,96,208,1625	6F	1320	DATA 208,223,177,253,10,145,253,136,16,248,32,92,113,32,28,113,2079
A2	770	DATA 160,32,39,112,169,0,160,32,153,0,96,136,16,250,169,1,1525	CD	1050	DATA 8,238,12,96,169,14,76,60,115,206,12,96,169,7,76,60,1414	CB	1330	DATA 76,49,115,160,1,177,253,136,145,253,200,200,192,8,208,245,2418
B5	780	DATA 141,34,208,169,2,141,35,208,32,193,112,201,73,208,3,32,1792	FD	1060	DATA 115,173,12,96,141,13,96,169,2,141,12,96,165,44,133,45,1453	31	1340	DATA 136,169,0,145,253,76,102,68,234,136,177,253,200,145,253,136,2483
73	790	DATA 65,71,201,67,208,24,2,32,222,112,160,136,169,32,153,255,96,2221	24	1070	DATA 173,0,98,141,14,96,169,6,141,0,98,169,31,133,44,96,1409	00	1350	DATA 136,16,247,200,152,145,253,76,102,68,177,253,74,145,253,136,2433
51	800	DATA 136,208,250,32,28,113,32,92,113,173,11,96,208,12,24,173,1701	54	1080	DATA 32,248,65,169,0,153,1,96,76,18,66,32,248,65,169,0,1438	FF	1360	DATA 16,248,76,102,68,169,10,162,12,160,0,32,8,115,169,8,1355
65	810	DATA 11,96,105,4,141,11,96,32,55,65,76,170,65,162,42,160,1291	18	1090	DATA 153,1,96,153,2,96,96,173,12,96,208,24,173,0,96,32,1411	17	1370	DATA 162,12,160,5,32,8,115,169,9,162,12,160,8,32,8,115,1169
84	820	DATA 4,152,72,32,155,113,104,168,202,202,136,136,16,243,24,165,1924	AS	1100	DATA 70,113,160,7,169,0,145,253,136,16,251,32,92,113,32,28,1617	BD	1380	DATA 32,149,115,240,29,32,70,113,165,253,133,251,165,254,133,252,2386
D2	830	DATA 38,105,82,133,38,165,39,105,129,133,39,165,40,105,103,133,1551	CB	1110	DATA 113,76,231,66,160,137,169,32,153,255,96,136,208,250,76,10,2168	86	1390	DATA 173,0,96,32,70,113,160,7,177,253,145,251,136,16,249,32,1910
22	840	DATA 40,165,41,105,129,133,41,165,42,105,174,133,42,165,43,105,1627	3C	1120	DATA 67,169,255,133,38,32,118,114,209,1,96,32,207,114,109,3,1696	54	1400	DATA 28,113,76,49,115,169,20,162,12,160,0,32,8,115,32,193,1284
4E	850	DATA 218,133,43,160,2,173,7,96,208,27,177,39,141,8,96,177,1702	1A	1130	DATA 96,168,173,3,96,208,2,200,202,185,0,97,153,255,96,200,2134	DB	1410	DATA 112,201,3,240,29,201,85,240,28,201,76,208,241,169,223,141,2398
AD	860	DATA 40,141,9,96,177,42,141,10,96,169,1,145,42,169,91,145,1514	D0	1140	DATA 202,208,246,169,32,153,255,96,173,3,96,240,3,206,3,96,2181	2E	1420	DATA 57,112,169,216,32,35,112,169,215,141,57,112,32,92,113,32,1696
1E	870	DATA 38,145,40,208,15,173,8,96,145,38,173,9,96,145,4	2D	1150	DATA 76,28,113,169,0,133,38,32,118,114,208,1,96,32,	84	1430	DATA 28,113,76,49,115,169,208,32,35,112,76,8,69,169



	,12,170,1441		4,165,254,201,2589		ED 2030 DATA 20,16,32,16,21,12,
78	1440 DATA 150,0,32,8,115,169	9D	1720 DATA 144,240,3,76,64,70		12,32,3,8,1,18,1,3,20,5,220
	,9,162,12,160,5,32,8,115,32,		,169,0,168,145,251,200,145,2	34	2040 DATA 18,32,40,14,44,19,
	149,1168		51,165,251,2342		44,5,44,23,41,32,32,18,32,18
82	1450 DATA 115,240,33,141,0,9	8E	1730 DATA 133,78,165,252,133		,456
	6,51,74,5,141,6,96,51,10,5,1		,79,169,8,32,97,116,173,224,	5A	2050 DATA 15,20,1,20,5,51,32
	33,1197		129,201,32,2021		,4,23,32,23,9,14,4,15,23,291
8A	1460 DATA 255,56,173,0,96,22	D1	1740 DATA 240,31,169,8,170,1	33	2060 DATA 32,3,15,14,20,18,1
	9,255,141,5,96,32,92,113,32,		60,96,32,186,255,32,88,117,1		5,12,32,58,32,3,8,1,14,7,284
	15,114,1704	0A	1750 DATA 79,169,1,133,251,1	4F	2070 DATA 5,32,20,15,32,12,5
55	1470 DATA 76,49,115,169,11,2		69,8,133,252,169,251,32,216,		,6,20,47,18,9,7,8,20,32,298
	2,21,117,240,37,197,43,144,3		255,32,140,2290	8A	2080 DATA 43,32,14,5,24,20,3
	3,32,70,1386	01	1760 DATA 112,76,49,115,169,		2,3,8,1,18,1,3,20,5,18,247
53	1480 DATA 113,165,61,133,251		,13,162,12,160,0,32,8,115,169	A7	2090 DATA 51,32,24,45,32,16,
	,165,62,133,252,24,165,253,1		,14,162,1368		18,5,22,9,15,21,19,32,3,8,35
	05,7,133,253,2275	46	1770 DATA 12,160,12,32,8,115	7A	2100 DATA 1,18,1,3,20,5,19,5
59	1490 DATA 144,2,230,254,169,		,32,193,112,201,3,240,229,20		1,32,60,3,21,18,19,15,18,303
	0,32,3,113,32,92,113,32,28,1		1,133,208,1890	DS	2110 DATA 19,44,18,5,20,21,1
	13,76,1433	47	1780 DATA 245,32,170,112,32,		8,14,44,4,5,12,5,20,5,44,298
74	1500 DATA 49,115,169,13,162,		49,115,169,0,141,21,208,133,	89	2120 DATA 5,20,3,32,58,32,13
	12,160,0,32,8,115,169,19,162	E1	1790 DATA 133,252,169,0,133,		,15,22,5,13,5,14,20,51,32,34
	,12,160,1357		253,169,149,133,254,169,231,	CB	2130 DATA 44,19,16,1,3,5,32,
CB	1510 DATA 12,32,8,115,32,193		133,38,169,131,2515		58,32,5,18,1,19,5,32,16,306
	,112,201,3,240,229,201,133,2	5B	1800 DATA 32,0,112,169,0,133	0B	2140 DATA 15,9,14,20,32,44,6
	08,245,104,2067		,251,169,216,133,252,169,0,1		,55,32,58,32,16,12,15,20,32,
EB	1520 DATA 104,76,226,252,169		33,253,169,2191	35	2150 DATA 16,15,9,14,20,51,3
	,128,141,11,96,76,49,65,169,	88	1810 DATA 152,133,254,169,23		2,44,3,20,18,12,47,18,22,19,
	7,32,97,1699		1,133,38,169,219,32,0,112,32	35	2160 DATA 32,15,14,32,58,32,
C2	1530 DATA 116,173,224,129,20		,110,75,169,2028		18,5,22,5,18,19,5,32,13,15,3
	1,32,240,32,173,254,101,170,	35	1820 DATA 211,133,251,169,71	90	2170 DATA 4,5,32,15,6,32,23,
	168,32,84,75,2204		,133,252,169,0,133,253,169,1		9,14,4,15,23,51,32,44,18,327
18	1540 DATA 173,255,101,162,0,		28,133,254,169,2629	5E	2180 DATA 21,14,47,19,20,15,
	160,102,32,189,255,169,0,32,	89	1830 DATA 83,133,38,169,75,3		16,32,58,32,1,2,15,18,20,32,
	213,255,32,2130		2,0,112,162,24,32,129,115,32	59	2190 DATA 3,15,13,13,1,14,4,
22	1550 DATA 28,113,32,92,113,3		,140,112,1389		51,32,56,24,32,58,32,5,24,37
	2,140,112,76,102,75,169,8,32	81	1840 DATA 169,15,141,21,208,	92	2200 DATA 9,20,32,16,18,15,7
	,97,116,1337		169,0,133,251,133,253,169,14		,18,1,13,32,186,255,32,49,11
40	1560 DATA 173,224,129,201,32		8,133,252,169,2364	3F	2210 DATA 169,0,141,21,208,1
	,240,31,173,254,101,170,160,	00	1850 DATA 128,133,254,169,23		68,162,12,24,76,240,255,169,
	96,32,186,255,2457		1,133,38,169,151,32,0,112,16	86	2220 DATA 208,76,49,115,160,
7E	1570 DATA 32,88,117,32,87,75		9,0,133,251,2103		250,169,32,153,255,127,153,2
	,169,0,170,133,251,169,136,1	28	1860 DATA 133,253,169,152,13	EB	2230 DATA 129,153,237,130,17
	33,252,169,2013		3,252,169,216,133,254,169,23		3,134,2,153,255,215,153,249,
37	1580 DATA 251,160,144,32,216		1,133,38,169,155,2759	D4	2240 DATA 153,237,218,136,20
	,255,76,213,69,169,21,162,12	F4	1870 DATA 76,0,112,32,2,32,2		8,224,96,31,216,243,65,29,25
	,160,0,32,1972		,18,9,14,7,32,4,15,23,14,392	70	2250 DATA 66,157,32,66,145,4
62	1590 DATA 8,115,162,15,32,12				9,66,136,64,66,32,137,66,87,
	9,115,144,237,32,49,115,169,	01	1880 DATA 32,3,8,1,18,1,3,20	5B	2260 DATA 72,189,66,13,220,6
	1,133,251,1707		,5,18,19,32,6,18,15,13,212		6,19,231,66,147,243,66,20,29
66	1600 DATA 169,8,133,252,169,	D9	1890 DATA 32,18,15,13,51,32,	85	2270 DATA 79,67,18,116,67,77
	0,133,253,169,136,133,254,16		8,3,32,3,15,16,25,32,3,8,306		,161,67,43,181,67,45,208,67,
	9,100,133,38,2249	8E	1900 DATA 1,18,1,3,20,5,18,5	15	2280 DATA 67,80,52,68,66,225
92	1610 DATA 169,10,133,39,169,		1,32,24,4,32,4,1,20,1,235		,68,67,161,68,68,9,70,71,25,
	1,133,40,169,158,133,41,169,	SD	1910 DATA 32,20,15,32,2,1,19	86	2290 DATA 69,83,69,73,36,71,
	97,133,42,1636		,9,3,51,32,25,5,32,5,18,301		76,172,69,83,219,69,88,130,6
82	1620 DATA 24,165,41,105,10,1	DC	1920 DATA 1,19,5,32,3,8,1,18	11	2300 DATA 161,67,51,0,5,15,6
	33,41,144,2,230,42,160,255,1		,1,3,20,5,18,19,32,32,217		7,79,78,84,82,79,76,32,78,79
	62,4,200,1718	34	1930 DATA 7,32,7,15,20,15,32	86	2310 DATA 87,32,65,84,20,76,
92	1630 DATA 177,253,208,10,152		,3,8,1,18,1,3,20,5,18,205		69,70,84,26,82,73,71,72,84,3
	,72,160,2,169,0,133,61,240,3	10	1940 DATA 51,32,4,8,32,19,5,	21	2320 DATA 87,73,78,68,79,97,
	7,133,255,2062		1,18,3,8,32,2,15,20,20,270		
C1	1640 DATA 152,72,169,0,133,6	CD	1950 DATA 15,13,32,23,9,14,4		
	2,160,255,169,255,133,61,200		,15,23,32,5,15,18,32,3,8,252		
	,165,255,133,2374	DA	1960 DATA 1,18,1,3,20,5,18,5		
16	1650 DATA 255,56,249,38,0,23		1,32,6,45,32,3,21,18,19,293		
	0,61,176,246,165,61,208,4,16	SF	1970 DATA 15,18,19,32,58,32,		
	5,62,240,2216		13,15,22,5,13,5,14,20,44,32,		
AC	1660 DATA 231,230,62,152,72,		357		
	232,138,168,24,165,61,105,48	37	1980 DATA 6,55,32,58,32,19,5		
	,145,251,104,2188		,12,5,3,20,51,32,5,9,32,376		
AB	1670 DATA 168,192,2,208,211,	48	1990 DATA 9,14,19,20,18,21,3		
	232,138,168,169,44,145,251,1		,20,9,15,14,19,51,32,26,12,3		
	04,168,192,15,2407	AE	2000 DATA 44,19,32,12,15,1,4		
42	1680 DATA 208,173,138,168,16		,44,19,1,22,5,32,3,8,1,262		
	0,0,24,232,138,101,251,145,2	E7	2010 DATA 18,1,3,20,5,18,19,		
	51,72,200,165,2426		51,32,16,13,32,13,21,12,20,2		
37	1690 DATA 252,105,0,145,251,	78	2020 DATA 9,3,15,12,15,21,18		
	72,200,165,41,145,251,200,16		,32,15,14,47,15,6,6,51,32,31		
	5,42,145,251,2430		1		
C4	1700 DATA 200,169,131,145,25				
	1,202,138,168,169,0,145,251,				
	104,133,252,104,2562				
CB	1710 DATA 133,251,24,169,16,				
	101,253,133,253,144,8,230,25				



# LISTINGS

61,80,82,69,83,83,32,83,80,6 5,1190	FE 2600 DATA 0,145,251,166,251, 228,253,208,6,166,252,229,25 4,240,8,230,2886	3,206,1955
3F 2330 DATA 67,69,32,66,65,82, 32,84,79,32,67,79,78,84,73,7 8,1067	AA 2610 DATA 251,208,238,230,25 2,208,234,96,162,0,169,64,13 3,251,169,164,2829	16 2890 DATA 1,96,32,92,113,32, 28,113,169,0,96,56,169,15,23 7,3,1252
76 2340 DATA 85,69,77,87,72,65, 84,32,68,73,82,69,67,84,73,7 9,1166	1A 2620 DATA 133,252,189,0,97,3 2,70,113,160,7,177,253,145,2 51,136,16,2031	11 2890 DATA 96,170,160,14,173, 4,96,133,255,24,101,255,136, 209,251,96,2172
3C 2350 DATA 78,63,82,70,82,79, 77,85,84,79,96,67,72,65,82,6 5,1225	3S 2630 DATA 249,24,165,251,105 ,8,133,251,144,2,230,252,232 ,224,120,208,2598	B3 2920 DATA 169,103,133,251,16 9,216,133,252,162,8,160,14,1 69,8,145,251,2343
43 2350 DATA 67,84,69,82,63,101 ,67,79,80,89,107,69,82,65,83 ,69,1255	CE 2640 DATA 225,96,133,253,169 ,17,133,254,160,3,165,253,10 ,133,253,165,2422	F4 2910 DATA 136,16,251,24,165, 251,105,40,133,251,144,2,230 ,252,202,208,2410
C1 2370 DATA 112,71,79,84,79,12 4,80,92,69,83,83,32,70,49,32 ,84,1213	SS 2650 DATA 254,42,133,254,136 ,208,243,96,169,82,133,251,1 69,129,133,252,2583	01 2920 DATA 233,76,66,114,24,7 2,32,240,255,104,170,169,0,2 02,240,7,2004
F2 2380 DATA 79,141,83,69,69,32 ,73,78,83,84,82,85,67,84,73, 79,1251	DB 2660 DATA 173,0,96,32,70,113 ,160,0,177,253,133,255,152,7 2,160,0,1846	AB 2930 DATA 168,185,96,98,202, 208,249,170,168,185,96,98,13 3,255,232,229,2771
EF 2390 DATA 78,83,152,70,73,76 ,69,32,78,65,77,69,63,166,69 ,73,1292	AS 2670 DATA 165,255,10,133,255 ,144,4,169,86,208,2,169,32,1 45,251,200,2229	13 2940 DATA 255,240,9,169,96,9 8,32,210,255,76,34,115,96,16 0,160,169,2194
0C 2400 DATA 83,67,32,79,82,32, 84,65,80,69,63,171,76,79,65, 68,1195	9A 2680 DATA 192,8,208,236,104, 168,24,165,251,105,40,133,25 1,144,2,230,2251	8C 2950 DATA 32,153,223,129,136 ,208,250,96,162,12,160,0,133 ,44,169,1,1908
5E 2410 DATA 176,83,65,86,69,19 1,69,98,73,84,201,85,80,80,8 9,82,1571	2S 2690 DATA 252,200,192,8,208, 210,96,185,1,96,72,185,2,96, 157,0,1960	81 2950 DATA 32,8,115,162,12,16 0,15,24,173,12,96,105,2,32,8 ,115,1071
57 2420 DATA 32,79,82,32,76,79, 87,69,82,32,83,69,84,63,215, 68,1232	A4 2700 DATA 0,169,0,160,3,157, 1,0,189,0,0,10,157,0,0,189,1 035	49 2970 DATA 24,169,20,109,12,9 6,168,169,4,162,12,32,8,115, 162,15,1277
84 2430 DATA 65,84,65,32,84,79, 32,66,65,83,73,67,133,39,160 ,0,1127	DB 2710 DATA 1,0,42,157,1,0,136 ,208,239,160,4,189,0,0,133,2 51,1521	19 2990 DATA 32,129,115,176,21, 173,12,96,208,9,238,12,96,16 9,14,133,1633
FC 2440 DATA 177,251,145,253,16 5,251,197,38,208,6,165,252,1 97,39,240,14,2598	56 2720 DATA 189,1,0,133,252,16 5,251,117,0,157,0,0,165,252, 117,1,1800	E6 2990 DATA 44,208,7,206,12,96 ,169,7,133,44,76,49,115,169, 5,160,1500
SF 2450 DATA 230,251,208,2,230, 252,230,253,208,230,230,254, 208,225,96,133,3241	67 2730 DATA 157,1,0,136,208,23 9,104,117,0,149,0,144,2,246, 1,96,1600	A3 3000 DATA 0,32,8,115,32,193, 112,201,32,240,5,201,3,208,2 45,24,1651
BB 2460 DATA 252,169,136,120,13 3,254,169,0,133,251,133,253, 169,255,133,38,2598	0B 2740 DATA 173,1,96,170,169,0 ,56,106,202,16,252,133,255,1 73,0,96,1898	89 3010 DATA 96,169,32,32,210,2 55,162,0,32,87,116,134,41,32 ,193,112,1703
F0 2470 DATA 169,43,133,1,169,2 15,32,0,112,169,47,133,1,88, 96,24,1432	ES 2750 DATA 32,70,113,172,2,96 ,177,253,96,160,14,173,4,96, 133,255,1846	1B 3020 DATA 166,41,201,3,240,2 34,201,64,176,241,201,13,240 ,32,201,20,2274
32 2480 DATA 173,11,96,105,4,14 1,11,96,173,25,208,41,1,208, 3,76,1372	50 2760 DATA 24,101,255,136,208 ,251,109,3,96,168,96,169,135 ,133,251,169,2304	59 3030 DATA 240,18,201,48,144, 229,224,3,240,225,32,210,255 ,232,32,87,2420
86 2490 DATA 126,234,165,2,240, 25,169,2,141,24,208,169,1,14 1,25,208,1880	42 2770 DATA 128,133,252,169,10 0,133,38,169,10,133,39,169,1 ,133,40,160,1807	BA 3040 DATA 116,76,166,115,224 ,0,240,211,32,210,255,202,16 ,240,224,0,2327
32 2500 DATA 198,2,169,1,141,18 ,208,169,27,141,17,208,76,12 6,234,169,1904	42 2780 DATA 0,173,0,96,162,255 ,133,255,56,165,255,249,38,0 ,232,176,2245	67 3050 DATA 240,201,169,32,32, 210,255,169,1,133,38,169,10, 133,39,169,2000
89 2510 DATA 9,141,24,208,169,1 ,141,25,208,133,2,169,185,14 1,18,208,1782	43 2790 DATA 245,138,105,48,145 ,251,200,165,255,192,3,208,2 31,96,169,168,2619	63 3060 DATA 100,133,40,162,4,1 69,157,32,210,255,202,208,24 8,169,3,170,2262
4D 2520 DATA 169,27,141,17,208, 76,126,234,120,169,67,141,20 ,3,169,112,1799	12 2800 DATA 133,251,169,218,13 3,252,162,8,160,5,169,7,145, 251,136,16,2215	AB 3070 DATA 168,32,186,255,169 ,0,32,189,255,32,192,255,162 ,3,32,198,2150
AD 2530 DATA 141,21,3,169,1,141 ,26,208,133,2,169,185,141,18 ,208,169,1735	8C 2810 DATA 251,160,38,145,251 ,160,39,145,251,24,165,251,1 05,40,133,251,2409	4C 3080 DATA 255,169,0,133,255, 160,2,132,42,32,229,255,164, 42,56,233,2158
1C 2540 DATA 27,141,17,208,88,9 6,120,169,49,141,20,3,169,23 4,141,21,1644	97 2820 DATA 144,2,230,252,202, 208,225,160,40,169,7,153,127 ,219,136,208,2491	07 3090 DATA 48,153,251,0,136,1 6,240,169,3,32,195,255,32,20 4,255,169,2158
A7 2550 DATA 3,169,240,141,25,2 08,169,8,141,24,208,88,96,32 ,159,255,1967	43 2830 DATA 250,96,173,12,96,2 08,93,173,0,96,32,70,113,56, 169,8,1635	05 3100 DATA 0,166,41,149,251,2 32,224,5,208,249,162,2,189,2 51,0,240,2369
4F 2560 DATA 32,228,255,240,248 ,96,32,193,112,201,32,208,24 9,32,170,112,2440	AB 2840 DATA 237,1,96,170,169,0 ,55,42,202,16,252,133,255,17 2,2,96,1899	84 3110 DATA 13,169,24,165,255, 117,38,133,255,176,11,136,20 8,245,202,16,2162
53 2570 DATA 169,0,141,21,208,1 69,47,133,1,96,169,103,133,2 51,169,129,1938	70 2850 DATA 56,233,1,133,252,4 9,253,133,251,56,165,38,240, 2,229,252,2343	6F 3120 DATA 235,165,255,162,1, 96,162,3,169,20,32,210,255,2 02,208,249,2423
AS 2580 DATA 133,252,162,136,16 0,0,138,145,251,200,232,240, 17,192,15,208,2481	1F 2860 DATA 229,255,49,253,133 ,252,165,251,166,38,240,4,10 ,76,181,114,2416	C7 3130 DATA 76,154,115,169,219 ,32,210,255,169,157,76,210,2 55,133,42,162,2434
DD 2590 DATA 245,24,165,251,105 ,40,133,251,144,234,230,252, 208,230,96,160,2768	03 2870 DATA 74,5,252,145,253,5 6,165,38,240,8,173,1,96,240, 3,206,1955	66 3140 DATA 12,160,0,32,8,115, 165,42,160,5,201,7,240,2,160 ,3,1312
		83 3150 DATA 162,12,169,16,32,9



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, 115, 32, 193, 112, 201, 3, 208, 3,
76, 49, 1391
7B 3160 DATA 115, 201, 68, 240, 8, 2
01, 84, 208, 239, 169, 1, 208, 2, 16
9, 8, 141, 2061
C1 3170 DATA 254, 101, 32, 49, 115,
169, 15, 162, 12, 160, 2, 32, 8, 115
, 169, 32, 1425
07 3180 DATA 32, 210, 255, 162, 3, 3
2, 87, 115, 134, 39, 32, 193, 112, 1
66, 38, 201, 1808
38 3190 DATA 3, 240, 203, 201, 13, 2
40, 39, 201, 20, 240, 25, 201, 32, 1
44, 233, 201, 2236
88 3200 DATA 129, 176, 229, 224, 15
, 240, 225, 32, 210, 255, 157, 0, 10
2, 232, 32, 87, 2344
08 3210 DATA 115, 76, 172, 115, 224
, 0, 240, 208, 32, 210, 255, 202, 16
, 240, 224, 0, 2331
7E 3220 DATA 240, 198, 142, 255, 10
1, 169, 32, 32, 210, 255, 169, 13, 1
62, 15, 160, 0, 2153
C3 3230 DATA 32, 8, 115, 24, 165, 42
, 105, 10, 162, 15, 160, 12, 32, 8, 1
15, 32, 1037
5E 3240 DATA 193, 112, 201, 3, 240,
8, 201, 133, 208, 245, 32, 124, 117
, 95, 76, 49, 2038

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FE 3250 DATA 115, 162, 12, 160, 0, 3
2, 8, 115, 169, 32, 32, 210, 255, 16
2, 7, 32, 1503
90 3260 DATA 15, 115, 169, 32, 32, 2
10, 255, 162, 9, 32, 15, 115, 32, 14
9, 115, 240, 1697
38 3270 DATA 34, 133, 43, 32, 70, 11
3, 165, 253, 133, 61, 163, 254, 133
, 62, 169, 8, 1829
CC 3280 DATA 162, 14, 162, 0, 32, 8,
115, 169, 9, 162, 14, 160, 3, 32, 8,
115, 1163
29 3290 DATA 76, 149, 115, 96, 173,
255, 101, 166, 186, 224, 1, 240, 9,
24, 105, 2, 1922
DC 3300 DATA 162, 254, 160, 101, 20
8, 4, 162, 0, 160, 102, 32, 189, 255
, 169, 64, 141, 2163
BC 3310 DATA 254, 101, 169, 58, 141
, 255, 101, 96, 32, 170, 112, 76, 23
1, 255, 0, 0, 2051
39 3320 DATA 169, 0, 133, 250, 169,
112, 133, 251, 169, 1, 133, 174, 13
3, 193, 169, 8, 2197
70 3330 DATA 133, 175, 133, 194, 16
9, 112, 133, 252, 169, 132, 133, 25
3, 160, 0, 177, 250, 2575
D4 3340 DATA 145, 174, 230, 250, 20
8, 2, 230, 251, 230, 174, 209, 2, 23

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0, 175, 165, 250, 2924
C3 3350 DATA 197, 252, 208, 234, 16
5, 251, 197, 253, 208, 228, 169, 11
, 133, 187, 169, 133, 2995
7D 3360 DATA 133, 188, 169, 11, 133
, 183, 169, 0, 133, 185, 160, 0, 185
, 219, 132, 240, 2240
CF 3370 DATA 6, 32, 210, 255, 200, 2
08, 245, 32, 207, 255, 240, 251, 20
1, 49, 240, 4, 2535
58 3380 DATA 201, 55, 48, 230, 41, 1
5, 133, 186, 76, 234, 245, 147, 17,
17, 73, 78, 1797
87 3390 DATA 80, 85, 84, 32, 58, 69,
86, 73, 67, 69, 32, 78, 85, 77, 66, 6
9, 1120
55 3400 DATA 82, 13, 17, 67, 65, 83,
61, 49, 32, 47, 32, 68, 73, 83, 75, 6
1, 908
BC 3410 DATA 32, 56, 32, 79, 82, 32,
57, 58, 45, 32, 0, 67, 72, 65, 82, 32
, 823
0A 3420 DATA 69, 68, 73, 84, 79, 82,
0, 0, 0, 0, 255, 255, 255, 255, 0,
1475

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## Mastering Raster



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10 ;MASTERING
20 ;THE
30 ;RASTER
40 ;
50 ;EXAMPLE 2 :-
60 ;3 BACKGROUNDS
70 ;
80 VIC ;-$D000
90 RASTER ;-$VIC+18
100 RASTERHI ;-$VIC+17
110 IRR ;-$VIC+25
120 IMR ;-$VIC+26
130 IRQVEC ;-$0314
140 IRQOLD ;-$EA31
150 LINE1 ;-$0
160 LINE2 ;-$100
170 LINE3 ;-$200
180 COLOR1 ;-$5
190 COLOR2 ;-$1
200 COLOR3 ;-$8
210 ;
220 ;*-$C000
230 ;
240 INIT SEI
250 LDA #LINE1 ;SET RASTER
260 STA RASTER ;LINE
270 LDA RASTERHI ;REMEMBERING TO
280 AND #%01111111 ;ERASE THE
290 STA RASTERHI ;HI BIT
300 LDA #%10000001 ;INTERRUPT BY
310 STA IMR ;RASTER LINE ONLY
320 LDA #TEST&255
330 STA IRQVEC
340 LDA #TEST/256
350 STA IRQVEC+1
360 CLI
370 RTS
380 ;
390 ;
400 TEST LDA IRR ;READ AND
410 STA IRR ;ERASE IRR
420 AND #%00000001 ;IS RASTER SOURCE
430 BNE ROUTINE ;YES

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440 LDA $DCOD
450 CLI
460 JMP IRQOLD ;NO
470 ;
480 ROUTINE LDA RASTER
490 CMP #LINE2 ;CHECK IF
500 BCS SECOND ;RASTER>=LINE2
510 ;
520 FIRST LDA #COLOR1
530 LDX #LINE2
540 COLOR
550
560 STA 53280
570 STA 53281
580 STX RASTER
590 ;
600 PLA ;RESTORE REGS
610 TAY
620 PLA
630 TAX
640 PLA
650 RTI
660 ;
670 SECOND CMP #LINE3
680 BCS THIRD
690 LDA #COLOR2
700 LDX #LINE3
710 JMP COLOR
720 THIRD LDA #COLOR3
730 LDX #LINE1
740 JMP COLOR

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10 ;MASTERING
20 ;THE
30 ;RASTER
40 ;
50 ;EXAMPLE 2 :-
60 ;16 SPRITES
70 ;
80 VIC ;-$D000
90 RASTER ;-$VIC+18
100 RASTERHI ;-$VIC+17
110 IRR ;-$VIC+25
120 IMR ;-$VIC+26
130 IRQVEC ;-$0314
140 IRQOLD ;-$EA31
150 LINE1 ;-$0
160 LINE2 ;-$130
170 TABLE1 ;-$C100
180 TABLE2 ;-$C200
190 ;
200 ;*-$C000
210 ;
220 INIT SEI
230 LDA #LINE1 ;SET RASTER
240 STA RASTER ;LINE
250 LDA RASTERHI ;REMEMBERING TO
260 AND #%01111111 ;ERASE THE
270 STA RASTERHI ;HI BIT

```



```

280 LDA #10000001 ; INTERRUPT BY
290 STA IMR ; RASTER LINE ONLY
300 LDA #TEST&255
310 STA IRQVEC
320 LDA #TEST/256
330 STA IRQVEC+1
340 CLI
350 RTS
360 ;
370 ;
380 TEST LDA IRR ; READ AND
390 STA IRR ; ERASE IRR
400 AND #00000001 ; IS RASTER SOURCE
410 BNE ROUTINE ; YES
420 LDA $DCOD
430 CLI
440 JMP IRQOLD ; NO
450 ;
460 ROUTINE LDA RASTER
470 CMP #LINE2 ; CHECK IF
480 BCS SECOND ; RASTER >= LINE2
490 ;
500 FIRST LDA #TABLE1&255
510 LDY #TABLE1/256
520 STA SFB
530 STY $FC
540 LDX #LINE2
550 COPY LDY #0
560 LDA ($FB),Y
570 LOOP STA VIC,Y
580 INY
590 CPY #16
600 BNE LOOP
610 SIX RASTER
620 ;
630 PLA ; RESTORE REGS
640 TAY
650 PLA
660 LIST TAX
670 PLA
680 RTI
690 ;
700 ;
710 ;
720 SECOND LDA #TABLE2&255
730 LDY #TABLE2/256
740 STA SFB
750 STY $FC
760 LDX #LINE1
770 JMP COPY

```

## Creating Characters



LIST 1

```

>7000 80 80 80 80 80 80 80 00 00 : AAAAAAAAAA
>7008 80 80 80 80 DE 80 80 00 00 : AAAAAAAAAA
>7010 80 84 83 80 84 83 00 00 : AAAAAAAAAA
>7018 80 94 BE 94 BE 94 00 00 : AAAAAAAAAA
>7020 80 84 AA FF AA 90 00 00 : AAAAAAAAAA
>7028 80 B1 89 A4 A3 80 00 00 : AAAAAAAAAA
>7030 80 94 AA FF AA A2 00 00 : AAAAAAAAAA
>7038 80 80 80 84 83 80 00 00 : AAAAAAAAAA
>7040 80 9C A2 C1 80 80 00 00 : AAAAAAAAAA
>7048 80 80 C1 A2 9C 80 00 00 : AAAAAAAAAA
>7050 80 AA 9C BE 9C AA 00 00 : AAAAAAAAAA
>7058 80 88 88 BE 88 88 00 00 : AAAAAAAAAA
>7060 80 80 80 C0 B0 80 00 00 : AAAAAAAAAA
>7068 80 88 88 88 88 88 00 00 : AAAAAAAAAA
>7070 80 80 80 B0 B0 80 00 00 : AAAAAAAAAA
>7078 80 A0 90 88 84 82 00 00 : AAAAAAAAAA
>7080 80 9E B1 AD A3 9E 00 00 : AAAAAAAAAA
>7088 80 80 A2 BF A0 80 00 00 : AAAAAAAAAA
>7090 80 B2 A9 A9 A9 A6 00 00 : AAAAAAAAAA
>7098 80 91 A1 A1 A5 98 00 00 : AAAAAAAAAA
>70A0 80 88 8C 8A BF 88 00 00 : AAAAAAAAAA
>70A8 80 97 A5 A5 A5 99 00 00 : AAAAAAAAAA

```

```

>70B0 80 9C A6 A5 A5 98 00 00 : AAAAAAAAAA
>70B8 80 81 81 B9 85 83 00 00 : AAAAAAAAAA
>70C0 80 9A A5 A5 A5 9A 00 00 : AAAAAAAAAA
>70C8 80 86 A9 A9 99 8E 00 00 : AAAAAAAAAA
>70D0 80 80 80 A4 A4 80 00 00 : AAAAAAAAAA
>70D8 80 80 80 C4 B4 80 00 00 : AAAAAAAAAA
>70E0 80 88 94 A2 A2 80 00 00 : AAAAAAAAAA
>70E8 80 94 94 94 94 94 00 00 : AAAAAAAAAA
>70F0 80 A2 A2 94 88 80 00 00 : AAAAAAAAAA
>70F8 80 82 81 A9 85 82 00 00 : AAAAAAAAAA
>7100 80 9E A1 AD A9 86 00 00 : AAAAAAAAAA
>7108 80 90 AA AA AA BC 00 00 : AAAAAAAAAA
>7110 80 BF A4 A2 A2 9C 00 00 : AAAAAAAAAA
>7118 80 9C A2 A2 A2 A2 00 00 : AAAAAAAAAA
>7120 80 9C A2 A2 A4 BF 00 00 : AAAAAAAAAA
>7128 80 9C AA AA AA 8C 00 00 : AAAAAAAAAA
>7130 80 80 84 BE 85 81 00 00 : AAAAAAAAAA
>7138 80 8C D2 D2 D2 BE 00 00 : AAAAAAAAAA
>7140 80 BF 84 82 82 BC 00 00 : AAAAAAAAAA
>7148 80 80 A4 BD A0 80 00 00 : AAAAAAAAAA
>7150 80 80 C0 C5 BD 80 00 00 : AAAAAAAAAA
>7158 80 BF 88 8C 92 A0 00 00 : AAAAAAAAAA
>7160 80 80 A1 BF A0 80 00 00 : AAAAAAAAAA
>7168 80 BE 82 BC 82 BC 00 00 : AAAAAAAAAA
>7170 80 BE 84 82 82 BC 00 00 : AAAAAAAAAA
>7178 80 9C A2 A2 A2 9C 00 00 : AAAAAAAAAA
>7180 80 FE 92 A2 A2 9C 00 00 : AAAAAAAAAA
>7188 80 9C A2 A2 92 FE 00 00 : AAAAAAAAAA
>7190 80 BE 84 82 82 84 00 00 : AAAAAAAAAA
>7198 80 A4 AA AA AA 90 00 00 : AAAAAAAAAA
>71A0 80 82 9F A2 A2 90 00 00 : AAAAAAAAAA
>71A8 80 9E A0 A0 A0 BE 00 00 : AAAAAAAAAA
>71B0 80 8E 90 A0 90 8E 00 00 : AAAAAAAAAA
>71B8 80 9E A0 98 A0 9E 00 00 : AAAAAAAAAA
>71C0 80 A2 B6 88 B6 A2 00 00 : AAAAAAAAAA
>71C8 80 8E D0 D0 D0 BE 00 00 : AAAAAAAAAA
>71D0 80 A2 B2 AA A6 A2 00 00 : AAAAAAAAAA
>71D8 80 80 FF C1 C1 80 00 00 : AAAAAAAAAA
>71E0 80 A8 BE A9 A9 A2 00 00 : AAAAAAAAAA
>71E8 80 80 C1 C1 FF 80 00 00 : AAAAAAAAAA
>71F0 80 80 82 BF 82 80 00 00 : AAAAAAAAAA
>71F8 80 88 9C 88 88 88 00 00 : AAAAAAAAAA
>7200 80 88 88 88 88 88 00 00 : AAAAAAAAAA
>7208 80 BC 8A 89 8A BC 00 00 : AAAAAAAAAA
>7210 80 A1 BF A5 A5 9A 00 00 : AAAAAAAAAA
>7218 80 9E A1 A1 A1 92 00 00 : AAAAAAAAAA
>7220 80 A1 BF A1 92 8C 00 00 : AAAAAAAAAA
>7228 80 A1 BF A5 A5 A1 00 00 : AAAAAAAAAA
>7230 80 A1 BF A5 85 81 00 00 : AAAAAAAAAA
>7238 80 9E A1 A1 A9 B9 00 00 : AAAAAAAAAA
>7240 80 BF 84 84 84 BF 00 00 : AAAAAAAAAA
>7248 80 80 A1 BF A1 80 00 00 : AAAAAAAAAA
>7250 80 90 A0 A1 9F 81 00 00 : AAAAAAAAAA
>7258 80 80 BF 8C 92 A1 00 00 : AAAAAAAAAA
>7260 80 A1 BF A1 A0 B0 00 00 : AAAAAAAAAA
>7268 80 BF 82 8C 82 BF 00 00 : AAAAAAAAAA
>7270 80 BF 82 84 88 BF 00 00 : AAAAAAAAAA
>7278 80 9E A1 A1 A1 9E 00 00 : AAAAAAAAAA
>7280 80 A1 BF A9 89 86 00 00 : AAAAAAAAAA
>7288 80 9E A1 A9 91 AE 00 00 : AAAAAAAAAA
>7290 80 A1 BF 89 99 A6 00 00 : AAAAAAAAAA
>7298 80 92 A5 A5 A5 98 00 00 : AAAAAAAAAA
>72A0 80 83 A1 BF A1 83 00 00 : AAAAAAAAAA
>72A8 80 9F A0 A0 A0 9F 00 00 : AAAAAAAAAA
>72B0 80 87 98 A0 98 87 00 00 : AAAAAAAAAA
>72B8 80 9F A0 9C A0 9F 00 00 : AAAAAAAAAA
>72C0 80 A1 B3 8C B3 A1 00 00 : AAAAAAAAAA
>72C8 80 83 A4 BC A4 83 00 00 : AAAAAAAAAA
>72D0 80 A3 B1 AD A3 B1 00 00 : AAAAAAAAAA

```



```

>72D8 88 88 88 FF 88 88 00 00 :
>72E0 00 55 2A 55 00 00 00 00 :
>72E8 00 00 00 00 7F 00 00 00 :
>72F0 00 04 3C 04 1C 02 00 00 :
>72F8 00 3E 41 5D 55 41 3E 00 :

```

## LIST 2

```

>7530 A9 FF 85 37 A9 67 85 38 :
>7538 A9 00 8D 24 03 A9 76 8D :
>7540 25 03 20 F5 05 00 00 00 :
>7548 00 00 00 00 00 00 00 00 :

```

## LIST 3

```

>7600 48 8A 48 A9 4B 8D 24 03 :
>7608 A9 EC 8D 25 03 A9 00 8D :
>7610 36 7A 8D 5E 3B A9 79 8D :
>7618 5F 3B A9 20 A2 00 9D A2 :
>7620 33 E8 E0 A7 D0 F8 A2 00 :
>7628 BD 3F 76 9D A2 33 F0 04 :
>7630 E8 4C 28 76 A9 80 8D 38 :
>7638 7A 68 AA 68 4C D2 FF 20 :
>7640 20 33 2D 50 4C 55 53 2D :
>7648 31 2E 20 41 4C 54 45 52 :
>7650 4E 41 54 49 56 45 20 46 :
>7658 4F 4E 54 2E 20 20 20 20 :
>7660 20 20 20 20 20 20 2E 20 :
>7668 20 20 20 20 20 20 20 20 :
>7670 20 20 20 20 20 20 20 20 :
>7678 20 20 20 20 20 20 20 20 :
>7680 20 20 20 20 20 20 20 20 :
>7688 20 20 20 20 20 20 20 20 :
>7690 20 46 52 41 4E 4B 20 43 :
>7698 41 52 53 4F 4E 2E 20 20 :
>76A0 20 28 4A 41 4E 20 31 39 :
>76A8 38 38 2E 29 00 00 00 00 :

```

## LIST 4

```

>7900 20 42 79 A5 AE C9 04 D0 :
>7908 16 AD 3C 7A C9 0E F0 27 :
>7910 C9 0F F0 21 C9 01 F0 0D :
>7918 C9 02 F0 11 4C 56 79 20 :
>7920 4C 79 4C A8 FF A9 82 8D :
>7928 41 7A 4C 3A 79 A9 80 8D :
>7930 41 7A 4C 3A 79 A9 00 8D :
>7938 3F 7A 20 4C 79 A9 0F 4C :
>7940 A8 FF 8D 3C 7A 8E 3D 7A :
>7948 8C 3E 7A 60 AD 3C 7A AE :
>7950 3D 7A AC 3E 7A 60 C9 0D :
>7958 F0 2D A9 08 20 A8 FF AE :
>7960 40 7A 20 73 79 AD 3F 7A :
>7968 F0 03 20 73 79 8E 40 7A :
>7970 4C 08 7A AD 41 7A 9D 00 :
>7978 7B AD 3C 7A C9 20 D0 05 :
>7980 A9 80 9D 00 7B E8 60 A9 :
>7988 08 20 A8 FF A9 0D 20 A8 :
>7990 FF AD 40 7A F0 1D A2 FF :
>7998 E8 6D 00 7B 20 A8 FF 20 :
>79A0 A8 FF 20 A8 FF 20 A8 FF :
>79A8 20 A8 FF 20 A8 FF EC 40 :
>79B0 7A D0 E5 A9 00 8D 40 7A :
>79B8 A9 0D 20 A8 FF 4C 3A 79 :
>79C0 8D CE 79 AD 3C 7A 0A 0A :
>79C8 0A AA A0 06 BD 00 70 8D :
>79D0 42 7A E8 88 F0 14 AD 3F :
>79D8 7A F0 06 AD 42 7A 20 A8 :
>79E0 FF AD 42 7A 20 A8 FF 4C :
>79E8 CC 79 AD 3F 7A F0 06 AD :
>79F0 42 7A 20 A8 FF AD 42 7A :
>79F8 20 A8 FF AD 40 7A C9 50 :
>7A00 F0 85 4C 3A 79 8D 45 7A :
>7A08 A9 08 20 A8 FF AD 3C 7A :
>7A10 C9 40 90 07 C9 60 90 0E :
>7A18 4C 31 7A 38 E9 20 8D 42 :
>7A20 7A A9 70 4C C0 79 38 E9 :
>7A28 40 8D 42 7A A9 71 4C C0 :
>7A30 79 38 E9 80 8D 42 7A A9 :
>7A38 72 4C C0 79 00 00 00 00 :
>7A40 00 00 00 00 00 00 00 00 :

```

## William Tell



Here is the second installment of the on-going William Tell saga. As with last month's installment, keep the finished program somewhere safe until we reach the end in a month or so, when full assemblage instructions will be given.

## PROGRAM: WT3.BAS

```

A9 10 BL=471 :LN=50 :SA=3276
B
F9 20 FOR L=0 TO BL:CX=0:FOR D=
0 TO 15
8B 21 READ A:POKE53280,A

```

```

9E 22 CX=CX+A:POKE SA+L*16+D,A:
NEXT
A2 30 READA:IF A=CX THEN40
12 31 PRINT"ERROR IN LINE";LN+(
L*10):STOP
16 40 NEXT L:SYS40136
F4 50 DATA 97,94,100,85,100,81,
65,73,74,65,73,74,66,65,84,6
5,1261
37 60 DATA 65,65,97,96,100,86,1
00,83,66,65,65,66,65,65,66,6
5,1215
4B 70 DATA 84,66,65,66,97,95,92
,85,100,81,65,73,74,66,73,74
,1256
53 80 DATA 65,66,123,125,66,65,
97,97,91,86,100,83,66,65,65,
65,1325
49 90 DATA 65,65,66,66,124,126,
65,66,97,97,90,85,100,81,65,
66,1324
71 100 DATA 65,66,66,65,65,65,6
5,65,66,66,97,90,100,86,87,8
3,1197
2A 110 DATA 66,70,72,72,65,66,6
5,73,74,74,65,66,94,100,100,
100,1222
A9 120 DATA 83,87,66,69,71,71,6
6,210,66,210,65,210,66,165,9
5,92,1692

```

```

41 130 DATA 100,92,100,83,65,65
,65,65,210,210,210,210,210,2
10,210,165,2270
AA 140 DATA 97,91,100,100,100,1
00,122,32,32,61,208,208,208,
208,208,208,2083
36 150 DATA 208,208,97,97,91,10
0,92,100,41,32,32,60,65,66,6
5,66,1420
83 160 DATA 66,66,65,66,97,97,9
4,92,100,100,41,32,32,61,66,
65,1140
E5 170 DATA 225,227,84,66,66,65
,97,97,95,100,92,92,122,77,7
5,60,1640
97 180 DATA 65,66,226,230,65,65
,66,66,97,97,94,92,100,100,4
1,78,1548
D1 190 DATA 32,61,66,65,66,165,
84,66,65,65,97,97,96,100,100
,100,1325
82 200 DATA 122,32,32,60,66,66,
210,165,66,210,66,66,97,97,9
6,100,1551
30 210 DATA 100,100,122,32,32,6
1,209,209,209,209,209,209,20
9,209,97,97,2313
99 220 DATA 96,100,86,88,63,63,
63,63,63,63,63,63,63,63,6
3,1126

```



# LISTINGS

E0	230 DATA 97,97,95,93,85,82,63,63,63,63,63,63,63,63,63,1179	C2	510 DATA 65,65,97,97,94,100,100,100,41,32,32,60,66,65,79,80,1173	F7	790 DATA 84,66,66,66,97,97,91,100,92,93,112,32,32,61,65,66,1220
ED	240 DATA 63,63,97,97,90,100,86,83,83,66,84,66,84,84,66,84,1296	BA	520 DATA 84,66,65,66,97,97,95,92,100,100,41,32,32,61,65,66,1159	53	800 DATA 79,80,119,66,65,66,97,97,96,100,93,100,112,32,32,60,1294
C6	250 DATA 84,66,84,66,97,94,100,100,85,81,66,73,74,165,73,74,1382	F1	530 DATA 79,80,119,66,66,65,97,97,97,91,93,100,122,32,32,60,1296	28	810 DATA 66,65,79,80,84,66,66,65,97,97,95,93,100,100,114,32,1299
41	260 DATA 65,65,66,73,74,65,97,95,100,100,86,83,65,65,65,165,1329	E6	540 DATA 66,65,79,80,65,66,65,66,97,97,97,90,93,100,41,32,1199	CF	820 DATA 32,61,66,66,79,80,84,128,127,127,97,97,90,100,47,27,1308
C8	270 DATA 165,65,66,66,66,65,65,66,97,97,92,100,100,87,84,73,1354	4A	550 DATA 32,61,66,66,79,80,84,65,66,65,97,97,90,93,100,100,1241	D8	830 DATA 28,59,32,60,65,65,79,80,84,65,66,66,97,94,93,100,1133
4D	280 DATA 74,65,73,74,165,66,66,73,74,66,97,94,100,92,100,83,1362	28	560 DATA 41,32,32,60,65,66,79,80,65,66,65,66,97,94,100,100,1108	06	840 DATA 100,43,42,0,32,61,66,65,79,80,65,66,66,65,97,96,1023
A1	290 DATA 65,65,65,165,165,165,165,65,165,165,165,210,97,95,100,100,2017	OC	570 DATA 93,100,122,32,32,61,66,65,79,80,84,128,127,127,97,95,1388	E3	850 DATA 100,100,100,44,46,0,32,60,65,66,79,80,84,65,66,66,1053
7F	300 DATA 100,122,122,32,32,61,208,208,79,80,208,208,208,208,97,97,2070	D6	580 DATA 100,92,100,100,41,77,75,60,66,65,79,80,84,65,65,66,1215	6D	860 DATA 97,95,100,92,100,44,46,0,32,61,66,66,79,80,119,66,1143
EA	310 DATA 91,100,100,122,121,32,32,60,66,65,79,80,66,210,66,65,1355	4C	590 DATA 97,97,91,100,100,100,122,78,32,61,66,66,79,80,84,66,1319	7D	870 DATA 65,66,97,97,91,100,100,44,30,33,32,60,66,65,79,80,1105
56	320 DATA 97,97,94,92,100,41,122,32,32,61,65,66,79,80,84,65,1207	72	600 DATA 66,65,97,97,97,91,92,100,122,32,32,60,65,65,79,80,1240	CC	880 DATA 84,66,66,65,97,97,97,91,100,44,46,0,32,61,65,66,1077
60	330 DATA 66,66,97,97,95,100,92,122,121,32,32,60,66,65,79,80,1270	21	610 DATA 65,66,65,66,97,97,97,97,92,100,41,32,32,61,66,66,1140	CE	890 DATA 79,80,84,65,66,66,97,97,97,90,47,29,46,0,32,60,1035
DE	340 DATA 84,66,65,66,97,97,94,93,100,41,122,32,32,61,66,66,1182	20	620 DATA 79,80,119,66,66,65,97,97,97,90,100,92,41,32,32,60,1213	BE	900 DATA 66,65,79,80,84,66,66,65,97,97,94,100,100,43,42,0,1144
9D	350 DATA 79,80,65,210,66,65,97,97,96,100,93,41,122,32,32,60,1335	EF	630 DATA 65,66,79,80,65,65,66,66,97,97,94,100,100,100,41,32,1213	F1	910 DATA 32,61,66,66,79,80,84,128,127,127,97,97,96,93,100,100,1433
26	360 DATA 65,66,79,80,66,65,66,66,97,97,95,93,100,122,121,32,1310	2C	640 DATA 32,61,66,65,79,80,84,66,65,65,97,97,96,92,100,100,1245	AD	920 DATA 76,0,32,60,65,66,79,80,65,66,65,65,97,97,95,100,1108
47	370 DATA 32,61,66,66,79,80,119,128,127,127,97,97,90,100,100,122,1491	25	650 DATA 122,32,32,60,66,65,79,80,65,66,66,66,97,97,96,100,1189	33	930 DATA 92,100,112,32,32,61,66,66,79,80,119,66,65,66,97,97,1230
6B	380 DATA 122,32,32,60,65,66,79,80,84,65,66,65,97,94,93,100,1200	13	660 DATA 100,100,41,32,202,61,65,66,79,80,84,128,127,127,97,97,1486	2A	940 DATA 97,91,100,100,114,32,32,60,66,65,79,80,65,65,66,66,1178
14	390 DATA 100,122,122,32,32,61,66,65,79,80,65,66,66,66,97,96,1215	AB	670 DATA 96,93,93,100,122,32,203,60,66,66,79,80,84,66,65,66,1371	OF	950 DATA 97,97,97,90,100,100,112,32,32,61,65,65,79,80,84,65,1256
F8	400 DATA 100,100,100,41,121,32,32,60,65,66,79,80,84,65,66,65,1156	F9	680 DATA 97,97,95,93,100,100,122,32,32,61,65,66,79,80,65,66,1250	BA	960 DATA 65,65,97,97,94,100,100,100,122,32,32,60,66,65,79,80,1254
64	410 DATA 97,95,100,92,100,122,32,202,61,66,66,79,80,84,66,1464	F1	690 DATA 66,65,97,97,90,100,100,100,114,32,32,60,66,65,79,80,1243	5D	970 DATA 84,66,65,66,97,97,95,92,100,100,41,32,32,61,65,66,1159
F2	420 DATA 65,66,97,97,91,100,100,41,121,32,203,60,66,65,79,80,1363	2D	700 DATA 119,66,65,66,97,94,100,100,100,100,111,112,32,61,209,209,1641	29	980 DATA 79,80,84,66,66,65,97,97,97,91,93,100,122,32,32,60,1261
B5	430 DATA 119,66,66,65,97,97,97,91,100,122,121,32,32,61,65,66,1297	C7	710 DATA 79,80,209,209,209,209,97,95,92,100,100,155,100,116,119,120,2089	6C	990 DATA 66,65,79,80,119,66,65,66,97,97,97,90,93,100,41,32,1253
BA	440 DATA 79,80,84,65,66,66,97,97,97,90,92,41,122,32,32,60,1200	CC	720 DATA 108,108,105,80,108,108,108,97,97,91,100,155,115,115,117,1720	B7	1000 DATA 32,61,66,66,79,80,66,65,66,65,97,97,90,93,100,100,1223
D5	450 DATA 66,65,79,80,84,66,66,65,97,97,94,100,100,92,122,32,1305	95	730 DATA 109,109,109,109,109,106,109,109,109,109,97,157,159,155,115,115,1885	7E	1010 DATA 122,32,32,60,65,66,79,80,65,66,65,66,97,94,100,100,1189
10	460 DATA 32,61,66,66,79,80,84,128,127,127,97,97,96,100,100,100,1440	65	740 DATA 115,117,73,74,109,109,109,106,109,70,72,109,97,158,161,156,1744	69	1020 DATA 93,100,122,32,32,61,66,65,79,80,84,128,127,127,97,95,1388
23	470 DATA 41,32,32,60,65,66,79,80,65,66,65,66,97,97,95,100,1106	7A	750 DATA 115,115,115,117,109,109,109,70,72,106,109,69,71,109,97,97,1589	62	1030 DATA 100,92,100,100,41,32,32,60,66,65,79,80,84,65,65,66,1127
90	480 DATA 92,100,122,32,32,61,66,66,79,80,119,66,65,65,97,97,1239	44	760 DATA 90,100,156,115,115,117,109,109,109,109,69,71,106,109,109,109,1702	CB	1040 DATA 97,97,91,100,100,100,122,32,32,61,66,66,79,80,84,66,1273
6D	490 DATA 97,91,100,100,41,32,32,60,66,65,79,80,65,65,66,66,1105	B9	770 DATA 97,94,100,100,100,156,115,118,73,74,104,104,104,107,104,104,1654	EC	1050 DATA 66,65,97,97,97,91,100,93,41,32,32,60,65,65,79,80,1160
3B	500 DATA 97,97,97,90,100,100,122,32,32,61,65,65,79,80,84,65,1266	79	780 DATA 104,104,97,95,100,92,100,100,113,114,32,60,66,66,79,80,1402	B9	1060 DATA 65,66,65,66,97,97,97,97,93,100,41,32,202,61,66,66,1311



# LISTINGS

16	1070 DATA 79,80,119,66,66,65,97,97,97,90,100,100,122,32,203,60,1473	20	1350 DATA 66,65,79,80,84,66,66,65,97,97,94,100,100,100,41,32,1232	26	1630 DATA 64,64,64,64,64,80,64,64,64,64,97,97,97,91,85,81,1204
9A	1080 DATA 65,66,79,80,65,65,66,66,97,97,90,93,100,100,41,32,1202	3D	1360 DATA 32,61,66,66,79,80,84,128,127,127,97,97,96,93,100,100,1433	48	1640 DATA 65,73,74,65,66,65,66,80,84,65,66,65,97,97,97,90,1215
32	1090 DATA 32,61,66,65,79,80,84,66,65,65,97,90,93,100,100,100,1243	6B	1370 DATA 122,32,32,60,65,66,79,80,119,66,65,65,97,97,95,100,1240	65	1650 DATA 86,83,66,65,65,66,210,66,66,98,98,98,98,98,97,97,1457
FS	1100 DATA 41,32,32,60,66,66,79,80,65,66,66,66,94,100,100,100,1113	9D	1380 DATA 92,100,41,32,32,61,66,66,79,80,66,66,65,66,97,97,1106	DO	1660 DATA 94,100,100,87,66,73,74,66,210,66,210,99,99,99,99,99,1641
36	1110 DATA 100,100,122,32,32,61,65,65,79,80,84,128,127,127,95,92,1389	85	1390 DATA 97,91,100,100,41,32,32,60,66,65,79,80,65,65,66,66,1105	23	1670 DATA 97,97,95,100,100,83,65,65,65,65,210,210,210,80,210,210,1962
43	1120 DATA 100,100,100,100,122,32,32,60,66,66,79,80,84,66,65,66,1218	47	1400 DATA 97,97,97,90,100,100,41,32,32,61,65,65,79,80,65,65,1166	92	1680 DATA 210,210,97,97,97,97,2,100,100,114,32,32,60,208,208,79,80,1816
55	1130 DATA 97,91,100,100,100,100,41,32,32,61,65,66,79,80,65,66,1175	46	1410 DATA 65,65,97,97,94,100,100,100,122,32,32,60,66,65,79,80,1254	36	1690 DATA 208,208,208,208,97,97,94,100,92,93,114,32,32,61,65,66,1775
9A	1140 DATA 66,65,97,97,92,100,100,100,41,32,32,60,66,210,79,80,1317	34	1420 DATA 84,66,65,66,97,97,95,92,100,100,122,32,32,61,65,66,1240	57	1700 DATA 79,80,65,66,65,66,97,97,96,100,93,100,112,32,32,60,1240
0B	1150 DATA 119,66,210,66,97,94,100,92,86,88,63,63,63,103,209,209,1728	38	1430 DATA 79,80,84,66,66,65,97,97,97,91,92,100,41,32,32,60,1179	DB	1710 DATA 66,65,79,80,119,66,66,65,97,97,95,93,100,93,114,32,1327
57	1160 DATA 79,80,209,209,209,209,97,95,92,100,85,82,63,63,63,63,1798	A0	1440 DATA 66,65,79,80,119,66,65,66,97,97,97,90,100,92,41,32,1252	74	1720 DATA 32,61,66,66,79,80,84,128,127,127,97,97,90,100,100,100,1434
85	1170 DATA 63,63,103,80,63,63,63,63,97,97,91,100,86,83,84,64,1263	F7	1450 DATA 32,61,66,66,79,80,210,65,66,65,97,97,90,93,100,100,1367	EE	1730 DATA 114,32,32,60,65,210,79,80,84,65,66,66,97,94,93,100,1337
B2	1180 DATA 64,64,64,64,64,80,64,64,64,64,97,97,97,91,85,81,1204	7A	1460 DATA 122,32,32,60,65,66,79,80,65,66,65,66,97,94,100,100,1189	88	1740 DATA 100,100,112,32,32,61,66,65,79,80,65,66,66,65,97,96,1182
67	1190 DATA 65,73,74,65,123,125,65,80,66,73,74,65,97,97,97,90,1329	2A	1470 DATA 93,100,41,32,32,61,66,65,79,80,84,128,127,127,97,95,1307	67	1750 DATA 100,100,92,100,112,32,32,60,65,66,79,80,84,65,66,66,1199
3C	1200 DATA 86,83,66,65,65,66,124,126,66,80,66,65,65,66,97,97,1283	AA	1480 DATA 100,92,100,100,41,32,202,60,66,65,79,80,65,65,65,66,1278	88	1760 DATA 97,95,100,92,100,100,114,32,32,61,66,66,79,80,84,66,1264
86	1210 DATA 94,100,100,87,66,73,74,66,210,65,66,80,65,73,74,66,1359	34	1490 DATA 97,97,91,100,100,100,122,32,203,61,66,66,79,80,66,65,1425	83	1770 DATA 65,66,97,97,91,100,100,100,114,32,32,60,66,65,79,80,1244
66	1220 DATA 97,97,96,100,93,83,65,65,65,65,210,210,65,80,210,210,1811	9B	1500 DATA 66,65,97,97,97,91,92,100,122,32,32,60,65,65,79,80,1240	E2	1780 DATA 119,66,66,65,97,97,97,91,100,100,114,32,202,61,65,66,1438
C2	1230 DATA 210,210,97,97,95,93,100,100,41,32,32,60,208,208,79,80,1742	D7	1510 DATA 65,66,65,66,97,97,97,97,91,100,41,32,32,61,66,66,1139	12	1790 DATA 79,80,84,65,66,66,97,97,97,90,92,100,112,32,203,60,1420
23	1240 DATA 208,208,208,208,97,97,94,100,100,100,122,32,32,61,65,66,1798	F2	1520 DATA 79,80,119,66,66,65,97,97,97,97,90,92,114,32,32,60,1283	BC	1800 DATA 66,65,79,80,84,66,66,65,97,97,94,100,100,100,114,32,1305
C1	1250 DATA 79,80,119,66,65,66,97,97,96,100,93,100,122,32,32,60,1304	5C	1530 DATA 65,66,79,80,210,65,66,66,97,97,97,90,100,100,112,32,1422	89	1810 DATA 32,61,66,66,79,80,84,128,127,127,97,97,96,93,100,100,1433
E8	1260 DATA 66,65,79,80,84,66,66,65,97,97,95,93,100,100,41,32,1226	74	1540 DATA 32,61,66,65,79,80,84,66,65,65,97,97,94,92,100,100,1243	58	1820 DATA 114,32,32,60,65,66,79,80,65,66,65,65,97,97,95,100,1178
C0	1270 DATA 32,61,66,66,79,80,84,128,127,127,97,97,90,100,100,100,1434	3A	1550 DATA 114,77,75,60,66,66,79,80,65,66,66,66,97,97,96,100,1270	23	1830 DATA 92,100,114,32,32,61,66,66,79,80,119,66,65,66,97,97,1232
85	1280 DATA 122,77,75,60,65,65,79,80,84,65,66,66,97,94,93,100,1288	C9	1560 DATA 100,100,112,78,32,61,65,65,79,80,84,128,127,127,97,97,1432	22	1840 DATA 97,91,100,100,112,32,32,60,66,65,79,80,65,65,66,66,1176
8C	1290 DATA 100,100,41,78,32,61,66,65,79,80,65,66,66,65,97,96,1157	1B	1570 DATA 96,93,93,100,114,32,32,60,66,66,79,80,84,66,65,66,1192	17	1850 DATA 97,97,97,90,100,100,122,32,32,61,65,65,79,80,84,65,1266
2C	1300 DATA 100,100,100,100,41,32,32,60,65,66,79,80,84,65,66,66,1136	2C	1580 DATA 97,97,95,93,100,100,114,32,32,61,65,66,79,80,119,66,1296	5E	1860 DATA 65,65,97,97,94,100,100,100,41,32,32,60,66,65,79,80,1173
2C	1310 DATA 97,95,100,92,100,100,122,32,32,61,66,66,79,80,119,66,1307	43	1590 DATA 66,65,97,97,90,100,100,100,114,32,32,60,66,210,79,80,1388	C5	1870 DATA 84,66,65,66,97,97,95,92,100,100,41,32,32,61,65,66,1159
92	1320 DATA 65,66,97,97,91,100,100,100,122,32,202,60,66,65,79,80,1422	F9	1600 DATA 210,66,210,66,97,94,100,100,86,88,63,63,63,103,209,209,1827	EC	1880 DATA 79,80,119,66,66,65,97,97,97,91,92,100,122,32,32,60,1295
5A	1330 DATA 65,66,66,65,97,97,97,91,100,100,41,32,203,61,65,66,1312	83	1610 DATA 79,80,209,209,209,209,97,95,92,100,85,82,63,63,63,63,1798	16	1890 DATA 66,65,79,80,65,66,65,66,97,97,97,90,93,100,122,32,1280
C6	1340 DATA 79,80,84,65,66,66,97,97,97,90,92,100,122,32,32,60,1259	11	1620 DATA 63,63,103,80,63,63,63,63,97,97,91,100,86,83,84,64,1263	67	1900 DATA 32,61,66,66,79,80,84,65,66,65,97,97,90,93,100,100,1241



# LISTINGS

55	1910 DATA 41,32,32,60,65,66,79,80,65,66,65,66,97,94,100,100,1108	AE	2190 DATA 100,100,122,32,32,61,66,65,79,80,65,66,66,65,97,96,1192	DD	2470 DATA 96,100,93,100,122,32,32,60,66,66,79,80,84,66,65,66,1207
46	1920 DATA 100,100,122,32,32,61,66,65,79,80,84,128,127,127,97,95,1395	1B	2200 DATA 100,100,100,100,122,32,32,60,65,66,79,80,84,65,66,66,1217	OE	2480 DATA 97,97,95,93,100,100,122,32,32,61,65,66,79,80,119,66,1304
12	1930 DATA 100,92,100,100,41,32,202,60,66,65,79,80,84,65,65,66,1297	BC	2210 DATA 97,95,100,92,100,100,41,32,202,61,66,66,79,80,119,66,1396	2D	2490 DATA 66,65,97,97,90,100,100,100,41,32,32,60,66,210,79,80,1315
DC	1940 DATA 97,97,91,100,100,100,41,32,203,61,66,66,79,80,84,66,1363	11	2220 DATA 65,66,97,97,91,100,100,100,122,32,203,60,66,65,79,80,1423	42	2500 DATA 210,66,210,66,97,94,100,100,86,88,63,63,63,103,209,209,1827
2F	1950 DATA 66,65,97,97,97,91,92,100,122,32,32,60,65,65,79,80,1240	57	2230 DATA 84,66,66,65,97,97,97,91,100,100,122,32,32,61,65,66,1241	6C	2510 DATA 79,80,209,209,209,209,97,95,92,100,85,82,63,63,63,63,1798
EE	1960 DATA 65,66,65,66,97,97,97,97,92,100,41,32,32,61,66,66,1140	85	2240 DATA 79,80,84,65,66,66,97,97,97,90,92,100,41,32,32,60,1178	2C	2520 DATA 63,63,103,80,63,63,63,63,97,97,91,100,86,83,84,64,1263
2C	1970 DATA 79,80,119,66,66,65,97,97,97,90,100,92,122,32,32,60,1294	74	2250 DATA 66,65,79,80,84,66,66,65,97,97,94,93,100,100,122,32,1306	87	2530 DATA 64,64,64,64,64,80,64,64,64,64,97,97,97,91,85,81,1204
67	1980 DATA 65,66,79,80,65,65,66,66,97,97,94,100,100,100,122,32,1294	F7	2260 DATA 32,61,66,66,79,80,84,128,127,127,97,97,96,100,100,100,1440	A1	2540 DATA 65,73,74,65,73,74,65,80,84,73,74,65,97,97,97,90,1246
8F	1990 DATA 32,61,66,65,79,80,84,66,65,65,97,97,95,92,100,100,1244	CE	2270 DATA 41,32,32,60,65,66,79,80,65,66,65,65,97,97,95,100,1105	32	2550 DATA 86,83,66,65,65,66,65,65,66,80,84,65,65,66,97,97,1181
BB	2000 DATA 41,32,32,60,66,66,79,80,65,66,66,66,97,97,97,97,97,1101	89	2280 DATA 92,100,41,32,32,61,66,66,79,80,119,66,65,66,97,97,1159	CB	2560 DATA 94,100,100,87,66,73,74,66,73,74,66,80,65,73,74,66,1231
65	2010 DATA 100,100,41,32,32,61,65,65,79,80,84,128,127,127,97,97,1315	40	2290 DATA 97,91,100,100,41,32,32,60,66,65,79,80,65,65,66,66,1105	1B	2570 DATA 97,97,95,100,100,83,65,65,65,65,210,210,210,80,210,210,1962
D7	2020 DATA 97,97,93,100,122,32,32,60,66,66,79,80,84,66,65,66,1205	92	2300 DATA 97,97,97,90,100,100,122,32,32,61,65,65,79,80,84,65,1266	54	2580 DATA 210,210,97,97,97,92,100,100,122,32,32,60,208,208,79,80,1824
15	2030 DATA 97,97,97,90,100,100,41,32,32,61,65,66,79,80,65,66,1168	8E	2310 DATA 65,65,97,97,94,100,100,100,122,32,32,60,66,65,79,80,1254	F4	2590 DATA 208,208,208,208,97,97,94,100,100,100,41,32,32,61,65,66,1717
8E	2040 DATA 66,65,97,97,90,100,93,100,114,32,32,60,66,210,79,80,1381	DD	2320 DATA 84,66,65,66,97,97,95,92,100,93,41,32,32,61,65,66,1152	74	2600 DATA 79,80,65,66,65,66,97,97,96,100,93,100,41,32,32,60,1169
ED	2050 DATA 119,66,210,66,97,94,100,100,100,100,111,112,32,61,209,209,1786	18	2330 DATA 79,80,119,66,66,65,97,97,97,91,93,100,122,32,32,60,1296	BE	2610 DATA 66,65,79,80,119,66,66,65,97,97,95,93,100,100,122,32,1342
E1	2060 DATA 79,80,209,209,209,209,97,95,92,100,100,155,115,116,119,120,2104	7B	2340 DATA 66,65,79,80,65,66,65,66,97,97,97,90,93,100,41,32,1199	7C	2620 DATA 202,61,66,66,79,80,84,128,127,127,97,97,90,100,100,1604
89	2070 DATA 108,119,120,80,108,108,108,97,97,91,100,155,115,115,117,1746	7F	2350 DATA 32,61,66,66,79,80,84,65,66,65,97,97,90,100,100,100,1248	E2	2630 DATA 41,32,203,60,65,210,79,80,84,65,66,66,97,94,93,100,1435
89	2080 DATA 109,109,109,109,109,109,106,109,109,109,97,157,159,155,115,115,1885	49	2360 DATA 41,32,32,60,65,66,79,80,65,66,65,66,97,94,100,100,1108	65	2640 DATA 100,41,122,32,32,61,66,65,79,80,65,66,66,65,97,96,1133
CS	2090 DATA 115,117,73,74,109,73,74,106,109,73,74,109,97,158,161,156,1678	52	2370 DATA 93,100,41,32,32,61,66,65,79,80,84,128,127,127,97,95,1307	23	2650 DATA 100,100,100,122,121,32,32,60,65,66,79,80,84,65,66,66,1238
BF	2100 DATA 115,115,115,117,109,109,109,109,109,106,109,109,109,109,109,109,1743	FD	2380 DATA 100,92,100,100,122,32,32,60,66,65,79,80,84,65,65,66,1208	79	2660 DATA 97,95,100,92,100,122,121,32,32,61,66,66,79,80,119,66,1328
BF	2110 DATA 90,100,156,115,115,117,109,109,109,109,109,109,109,109,109,109,1780	8C	2390 DATA 97,97,91,100,100,100,41,32,32,61,66,66,79,80,84,66,1192	69	2670 DATA 65,66,97,97,91,100,100,122,121,32,32,60,66,65,79,80,1273
22	2120 DATA 97,94,100,100,100,156,115,118,73,74,104,73,74,107,104,73,1562	FB	2400 DATA 66,65,97,97,97,91,92,100,122,32,202,60,65,65,79,80,1410	4F	2680 DATA 65,66,66,65,97,97,97,91,100,41,122,32,32,61,65,66,1163
BC	2130 DATA 74,104,97,95,100,92,100,100,113,114,32,60,66,66,79,80,1372	C3	2410 DATA 119,66,65,66,97,97,97,97,92,100,122,32,203,61,66,66,1446	61	2690 DATA 79,80,84,65,66,66,97,97,97,90,92,100,41,32,32,60,1178
75	2140 DATA 84,66,66,66,97,97,91,100,100,100,112,32,32,61,65,66,1235	EC	2420 DATA 79,80,84,66,66,65,97,97,97,90,100,92,41,32,32,60,1178	OF	2700 DATA 66,65,79,80,84,66,66,65,97,97,94,100,100,100,122,32,1313
CB	2150 DATA 79,80,119,66,65,66,97,97,96,92,100,100,112,77,75,60,1381	FC	2430 DATA 65,66,79,80,65,65,66,66,97,97,94,100,100,100,41,32,1213	7B	2710 DATA 32,61,66,66,79,80,84,128,127,127,97,97,96,100,100,100,1440
22	2160 DATA 66,65,79,80,84,66,66,65,97,97,95,93,92,100,114,78,1337	AB	2440 DATA 32,61,66,66,79,80,84,66,65,65,97,97,96,100,100,100,1254	1E	2720 DATA 122,32,32,60,65,66,79,80,119,66,65,65,97,97,95,100,1240
4B	2170 DATA 32,61,66,66,79,80,84,128,127,127,97,97,90,100,100,100,1434	1E	2450 DATA 122,32,32,60,66,65,79,80,65,66,66,66,97,97,96,100,1189	8E	2730 DATA 92,100,41,32,32,61,66,66,79,80,84,66,65,66,97,97,1124
AB	2180 DATA 112,32,32,60,65,210,79,80,84,65,66,66,97,94,100,100,1342	89	2460 DATA 100,100,41,32,32,61,65,66,79,80,84,128,127,127,97,97,1316	D3	2740 DATA 97,91,100,100,122,32,32,60,66,65,79,80,65,65,66,66,1186



# LISTINGS

26	2750 DATA 97,97,97,90,100,100,122,32,32,61,65,65,79,80,84,65,1266	D2	3030 DATA 66,66,97,91,100,92,86,86,88,63,63,70,100,100,100,80,1348	18	3310 DATA 66,65,40,32,66,65,66,66,66,65,65,66,66,65,66,65,990
49	2760 DATA 65,65,97,97,94,100,100,100,122,32,32,60,66,65,79,80,1254	17	3040 DATA 63,63,63,63,97,97,91,100,85,100,82,63,166,166,166,166,1631	D6	3320 DATA 65,65,66,66,39,32,65,66,65,65,66,66,65,66,65,66,988
3C	2770 DATA 84,66,65,66,97,97,95,92,100,100,41,32,32,61,65,66,1159	6C	3050 DATA 166,166,63,63,63,63,97,97,96,92,86,100,83,84,84,84,1487	DF	3330 DATA 65,66,66,66,66,65,40,32,66,66,65,66,65,66,66,65,991
B3	2780 DATA 79,80,119,66,66,65,97,97,97,91,100,100,122,32,32,60,1303	53	3060 DATA 66,84,84,84,84,84,84,84,97,97,95,93,85,100,81,65,1367	16	3340 DATA 66,65,66,225,227,65,65,66,32,39,65,66,66,65,66,73,1317
3A	2790 DATA 66,65,79,80,65,66,65,66,97,97,97,90,92,100,41,32,1198	3D	3070 DATA 64,165,165,165,165,65,64,65,64,64,97,97,90,100,86,100,1616	B6	3350 DATA 74,66,65,66,65,226,230,66,66,65,39,32,66,65,66,66,1323
4C	2800 DATA 32,61,66,66,79,80,84,65,66,65,97,97,90,100,100,100,1248	21	3080 DATA 83,66,66,65,73,74,66,66,70,72,65,66,97,94,93,100,1216	63	3360 DATA 66,65,65,65,66,66,65,66,66,65,66,32,32,66,66,6,983
62	2810 DATA 41,32,32,60,65,66,79,80,65,66,65,66,97,94,100,100,1108	F5	3090 DATA 85,100,81,128,127,127,65,65,66,65,69,71,66,65,97,96,1373	83	3370 DATA 65,66,66,66,65,66,66,65,66,65,65,66,66,65,39,32,989
CE	2820 DATA 100,100,122,32,32,61,66,65,79,80,84,128,127,127,97,95,1395	D7	3100 DATA 100,100,86,100,83,65,66,66,70,72,65,66,65,66,66,1202	68	3380 DATA 65,66,66,66,65,65,66,65,66,66,66,65,66,66,66,1050
99	2830 DATA 100,92,100,100,122,32,32,60,66,65,79,80,84,65,65,66,1208	DC	3110 DATA 97,95,100,92,85,100,81,66,65,65,69,71,66,65,66,66,1249	FB	3390 DATA 32,39,165,165,165,165,165,165,165,165,165,165,165,165,165,165,2381
50	2840 DATA 97,97,91,100,100,100,41,32,32,61,66,66,79,80,84,66,1192	23	3120 DATA 65,66,97,97,91,100,86,100,83,65,66,66,65,65,66,66,1244	BC	3400 DATA 165,165,32,32,204,204,204,204,204,204,204,204,204,204,204,204,2842
11	2850 DATA 66,65,97,97,97,91,100,100,122,32,202,60,65,65,79,80,1418	0D	3130 DATA 70,72,66,65,97,97,97,91,85,100,81,128,127,127,66,66,1435	A4	3410 DATA 204,204,204,204,207,39,32,206,206,206,206,206,206,206,206,2950
41	2860 DATA 119,66,65,66,97,97,97,97,93,100,122,32,203,61,66,66,1447	91	3140 DATA 65,66,69,71,66,66,97,97,97,90,86,100,83,65,66,66,1250	46	3420 DATA 206,206,206,206,206,206,206,206,206,206,206,206,206,206,206,206,2938
18	2870 DATA 79,80,84,66,66,65,97,97,97,90,93,100,122,32,32,60,1260	DE	3150 DATA 70,72,66,65,84,65,65,65,97,97,94,100,85,100,81,66,1272	07	3430 DATA 204,204,204,204,204,204,204,204,204,204,204,204,204,206,206,206,2770
50	2880 DATA 65,66,79,80,65,65,66,66,97,97,94,100,100,100,41,32,1213	95	3160 DATA 65,65,69,71,65,66,84,65,66,66,97,97,96,100,86,100,1258	59	3440 DATA 206,206,206,216,213,100,100,215,228,40,39,39,204,204,204,204,2624
FE	2890 DATA 32,61,66,65,79,80,84,66,65,65,97,97,96,100,100,100,1253	72	3170 DATA 83,128,127,127,65,65,66,66,70,72,65,66,97,97,95,100,1389	C3	3450 DATA 204,204,204,204,204,204,213,100,100,100,214,32,40,32,32,206,206,2295
70	2900 DATA 122,32,32,60,66,66,79,80,65,66,66,66,97,97,95,100,1189	90	3180 DATA 85,100,81,66,66,66,73,74,66,65,69,71,66,66,97,97,1208	42	3460 DATA 206,206,206,206,206,206,206,206,211,211,211,211,229,40,39,32,32,2658
BB	2910 DATA 100,100,41,32,202,61,65,65,79,80,84,128,127,127,97,97,1485	3F	3190 DATA 97,91,86,100,83,66,65,66,65,65,66,66,66,65,65,66,66,1178	67	3470 DATA 204,204,204,204,204,204,204,204,204,204,204,204,204,204,204,204,2758
A3	2920 DATA 94,92,93,100,41,32,203,60,66,66,79,80,84,66,65,66,1287	EA	3200 DATA 65,65,65,65,65,65,65,65,65,65,66,65,66,65,66,66,66,5,1044	83	3480 DATA 32,39,208,208,208,208,208,208,208,208,208,208,208,208,208,208,2675
13	2930 DATA 97,97,95,93,100,100,114,32,32,61,65,66,79,80,119,66,1296	2A	3210 DATA 32,40,66,65,66,65,66,66,128,127,127,66,65,66,66,66,65,1176	7D	3490 DATA 32,39,32,32,66,65,66,65,66,65,66,66,65,66,65,66,922
B2	2940 DATA 66,65,97,97,90,100,100,100,112,77,75,60,66,66,79,80,1330	98	3220 DATA 66,66,32,32,66,66,65,66,66,65,66,65,66,65,66,65,983	09	3500 DATA 68,39,40,32,32,32,65,66,65,66,65,66,65,66,66,65,898
6B	2950 DATA 84,66,65,66,97,94,100,100,100,100,112,78,32,61,66,65,1286	B1	3230 DATA 66,65,65,66,39,39,65,66,65,66,65,66,65,66,65,66,6,995	A1	3510 DATA 66,65,68,40,40,39,39,32,66,65,66,65,66,65,66,65,913
CE	2960 DATA 79,80,84,65,66,65,97,95,92,100,100,100,114,32,32,60,1261	11	3240 DATA 65,66,65,66,66,65,32,32,66,65,66,65,66,73,74,65,997	E1	3520 DATA 66,66,65,66,68,40,39,32,32,39,66,65,66,66,65,66,907
F2	2970 DATA 65,66,79,80,84,66,65,66,97,97,91,100,100,100,112,32,1300	93	3250 DATA 66,65,66,225,227,65,66,66,32,40,65,66,65,66,66,66,65,1311	4C	3530 DATA 65,66,66,65,66,66,68,32,32,39,39,32,65,66,66,65,898
19	2980 DATA 32,61,66,65,79,80,84,66,66,65,97,97,90,92,100,100,1240	7E	3260 DATA 65,65,66,65,65,226,230,66,66,65,40,32,65,65,66,66,1313	AF	3540 DATA 66,65,66,66,65,66,66,65,68,39,39,32,39,39,66,65,912
BB	2990 DATA 112,32,32,60,66,66,79,80,65,128,127,127,97,90,93,100,1354	50	3270 DATA 65,66,65,66,65,66,66,65,65,66,65,66,32,39,66,66,989	53	3550 DATA 65,66,65,66,128,127,127,66,66,66,68,40,32,32,32,1078
05	3000 DATA 100,100,114,32,32,61,65,66,79,80,119,65,66,65,94,100,1238	5A	3280 DATA 65,65,66,66,66,65,66,66,65,66,65,66,65,66,32,32,983	CF	3560 DATA 65,66,65,66,65,66,188,188,188,188,188,188,188,188,188,188,1699
56	3010 DATA 100,100,86,88,63,63,63,60,66,66,79,80,65,66,65,66,1176	F5	3290 DATA 66,65,66,66,65,65,66,66,65,66,66,65,66,65,66,65,1050	45	3570 DATA 39,32,66,65,66,65,66,65,171,192,192,192,192,191,40,1826
82	3020 DATA 95,100,100,100,85,82,63,119,120,62,165,165,79,80,84,65,1564	DF	3300 DATA 32,40,65,66,65,66,66,73,74,65,66,66,65,66,66,65,1006	A3	3580 DATA 32,40,32,32,66,65,66,66,65,189,193,192,192,192,192,192,1806



# LISTINGS

BA	3590 DATA 191,39,32,39,32,39,65,66,65,66,66,190,193,192,192,192,1659	50	3870 DATA 201,201,200,40,39,32,32,39,64,66,65,115,201,201,201,201,1898	C9	4150 DATA 66,65,66,66,68,39,39,39,32,40,65,66,65,66,66,65,913
AD	3600 DATA 192,192,191,32,40,32,39,32,66,65,66,65,66,65,170,192,1505	D9	3880 DATA 201,201,201,201,200,39,39,39,32,32,97,65,66,115,201,201,1930	88	4160 DATA 66,65,66,65,65,66,68,40,40,32,40,32,65,65,66,65,907
70	3610 DATA 192,192,192,192,191,39,39,39,32,39,65,66,65,66,65,66,1540	03	3890 DATA 201,201,201,201,201,201,200,40,40,40,39,39,66,66,66,115,1917	0E	4170 DATA 65,66,65,66,65,66,66,66,68,32,39,40,32,39,66,65,907
54	3620 DATA 65,66,66,65,66,66,68,39,32,40,39,32,66,65,66,65,907	02	3900 DATA 201,201,201,201,201,201,201,200,39,32,40,32,65,66,2114	E7	4180 DATA 65,65,66,66,66,65,66,65,66,65,68,39,39,39,32,32,904
7C	3630 DATA 66,65,128,127,127,66,66,65,68,32,39,39,32,32,65,66,1083	84	3910 DATA 65,115,201,201,201,201,201,201,201,200,39,40,39,32,32,2170	9B	4190 DATA 66,65,66,66,65,65,66,66,65,66,65,66,68,40,39,39,973
6A	3640 DATA 65,66,65,66,65,65,66,65,65,66,68,40,39,40,32,39,912	70	3920 DATA 66,65,66,115,201,201,201,201,201,201,201,201,201,201,200,39,32,2230	7F	4200 DATA 32,40,65,66,65,65,66,73,74,74,74,65,66,66,68,32,991
5E	3650 DATA 65,65,65,65,65,65,65,65,65,66,68,39,39,40,968	F5	3930 DATA 32,39,66,65,66,115,201,201,201,201,201,201,201,201,201,200,40,2231	C5	4210 DATA 39,32,40,32,66,65,66,66,66,65,65,65,65,65,66,65,928
D4	3660 DATA 32,40,66,65,66,65,66,66,128,127,127,66,65,66,68,32,1145	D5	3940 DATA 32,39,32,32,66,66,65,115,201,201,201,201,201,201,201,201,2055	EB	4220 DATA 68,40,40,32,39,32,65,66,65,65,66,66,65,66,65,65,906
44	3670 DATA 32,39,32,32,66,66,65,66,66,65,66,65,66,65,66,65,922	54	3950 DATA 200,39,40,32,32,32,65,65,66,115,201,201,201,201,201,201,1892	7F	4230 DATA 65,66,68,39,39,39,40,32,66,66,65,66,65,66,66,65,913
C2	3680 DATA 68,40,40,40,39,39,65,66,65,66,65,66,65,66,65,65,921	48	3960 DATA 201,201,200,40,40,39,39,32,66,66,65,66,66,66,65,66,1319	2E	4240 DATA 66,65,66,65,68,39,40,32,32,39,65,66,66,65,66,65,906
A6	3690 DATA 65,66,68,39,39,32,32,32,66,65,66,65,66,73,74,65,913	C5	3970 DATA 66,66,66,66,68,40,39,32,32,39,66,65,66,66,65,65,908	D8	4250 DATA 65,66,65,66,65,66,68,40,39,32,39,32,66,65,66,65,906
1D	3700 DATA 66,65,66,66,68,39,39,39,32,40,65,66,65,66,66,65,913	F8	3980 DATA 65,66,66,65,66,66,68,32,32,39,39,32,65,66,66,65,898	B4	4260 DATA 66,65,66,65,66,66,65,66,68,40,32,39,32,32,66,65,900
F4	3710 DATA 65,65,66,65,65,66,68,40,40,32,40,32,65,65,66,65,906	A3	3990 DATA 66,65,66,66,65,65,66,65,68,39,39,32,39,39,66,65,911	33	4270 DATA 65,66,65,66,65,66,65,65,66,65,68,32,39,32,39,32,896
3E	3720 DATA 65,66,65,66,65,66,66,65,68,32,39,40,32,39,66,65,906	3F	4000 DATA 65,66,65,66,128,127,127,66,65,66,68,40,32,32,32,2,1077	CF	4280 DATA 65,65,66,66,65,65,66,65,66,66,65,66,68,39,39,32,964
45	3730 DATA 65,65,66,66,66,65,66,66,65,66,68,39,39,39,32,32,905	24	4010 DATA 65,66,65,66,65,66,65,65,65,65,66,65,68,32,39,39,962	E9	4290 DATA 32,39,66,65,66,65,66,66,66,65,127,127,127,66,65,68,40,1150
F1	3740 DATA 66,65,66,65,65,65,66,66,65,66,66,65,68,40,39,39,972	38	4020 DATA 39,32,66,65,66,65,66,65,66,65,66,66,65,68,40,966	28	4300 DATA 32,40,32,32,65,66,65,66,65,66,66,65,188,188,188,188,1412
99	3750 DATA 32,40,65,66,65,66,66,73,74,66,65,66,65,66,68,32,975	85	4030 DATA 32,40,32,32,66,65,66,66,65,66,65,70,72,66,65,65,934	B7	4310 DATA 68,39,40,39,39,32,65,65,66,65,66,66,65,171,193,193,1272
69	3760 DATA 39,32,40,32,66,65,66,66,66,65,65,66,65,66,65,65,929	80	4040 DATA 68,39,32,39,32,39,65,66,65,66,66,65,66,69,71,65,913	3C	4320 DATA 193,193,196,40,39,32,32,39,66,66,65,123,125,65,189,193,1656
FF	3770 DATA 68,40,40,32,39,32,65,66,65,65,66,66,65,66,65,65,906	15	4050 DATA 66,65,68,32,40,32,39,32,66,65,66,65,66,65,66,65,898	7F	4330 DATA 193,193,193,193,193,193,39,39,39,32,32,65,66,66,124,126,66,1662
EB	3780 DATA 65,66,68,39,39,39,40,32,66,66,65,66,65,66,66,65,913	B9	4060 DATA 65,66,65,66,68,39,39,39,32,39,65,66,65,66,65,65,911	C1	4340 DATA 190,193,193,193,193,193,193,196,40,40,40,39,39,66,65,66,66,1812
82	3790 DATA 66,65,66,65,68,39,40,32,32,39,65,66,66,65,66,65,906	EF	4070 DATA 65,66,66,65,66,66,68,39,32,40,39,32,66,65,66,65,907	8C	4350 DATA 65,66,65,170,193,193,193,193,193,196,39,32,40,32,32,66,66,1641
74	3800 DATA 65,66,65,66,65,66,68,40,39,32,39,32,66,65,66,65,906	C4	4080 DATA 66,65,66,66,65,66,66,65,68,32,39,39,32,32,65,65,898	51	4360 DATA 65,65,66,65,66,65,66,66,66,66,68,39,40,39,32,32,906
05	3810 DATA 66,65,66,123,125,66,65,66,68,40,32,39,32,32,66,66,1017	AB	4090 DATA 65,66,65,66,65,65,66,65,66,68,40,39,40,32,39,912	A6	4370 DATA 65,65,66,66,65,66,65,127,127,127,65,66,68,39,39,32,1148
04	3820 DATA 65,66,65,66,66,124,126,65,66,65,68,32,39,32,39,32,1016	6A	4100 DATA 65,65,65,65,65,65,65,65,66,65,66,68,39,39,40,968	89	4380 DATA 32,39,66,66,65,66,65,66,66,65,65,66,65,68,40,966
48	3830 DATA 65,65,66,66,66,65,66,65,66,66,65,66,68,39,39,32,965	D0	4110 DATA 32,40,66,65,66,65,66,66,66,128,127,127,66,65,66,68,32,1145	C9	4390 DATA 32,39,32,32,66,65,66,65,66,65,66,66,66,65,65,65,922
3D	3840 DATA 32,39,66,65,66,188,188,188,188,188,188,188,188,188,188,2068	48	4120 DATA 32,39,32,32,66,66,65,66,66,65,66,65,66,65,66,65,922	E3	4400 DATA 68,39,40,32,32,32,65,66,65,66,65,66,65,66,65,65,898
A6	3850 DATA 32,40,32,32,65,66,65,115,201,201,201,201,201,201,201,201,2055	26	4130 DATA 68,40,40,40,39,39,65,66,65,66,65,66,65,66,65,65,921	29	4410 DATA 66,65,68,40,40,39,39,32,66,65,66,65,66,65,66,65,913
D8	3860 DATA 200,39,40,39,39,32,65,66,66,115,201,201,201,201,201,201,1907	7F	4140 DATA 65,66,68,39,39,32,32,32,66,65,66,65,66,65,66,65,897	B3	4420 DATA 66,66,65,65,68,40,39,32,32,39,66,65,66,66,65,65,906



44	4430 DATA 65,66,66,65,66,66,68,32,32,39,39,32,65,66,66,65,898	07	4540 DATA 65,66,65,66,65,65,66,65,66,68,40,39,40,32,39,912		0,0,169,0,133,250,169,128,133,251,1567
8F	4440 DATA 66,65,66,66,65,65,66,65,68,39,39,32,39,39,66,65,911	E5	4550 DATA 65,65,65,65,65,65,65,65,66,65,66,68,39,39,40,968	89	4660 DATA 169,0,133,174,133,193,169,64,133,175,133,194,169,200,133,252,2424
93	4450 DATA 65,66,65,66,128,127,127,66,65,66,68,40,32,32,32,1077	CD	4560 DATA 32,40,66,65,66,65,66,66,128,127,127,66,65,66,68,32,1145	21	4670 DATA 169,156,133,253,160,0,177,250,145,174,230,250,208,2,230,251,2788
DO	4460 DATA 65,66,65,66,65,66,65,65,66,65,66,68,32,39,39,962	05	4570 DATA 32,39,32,32,66,66,65,66,65,66,65,66,65,66,65,922	E7	4680 DATA 230,174,208,2,230,175,165,250,197,252,208,234,165,251,197,253,3191
1F	4470 DATA 39,32,66,65,66,65,66,65,66,65,66,66,65,66,68,40,966	47	4580 DATA 68,40,40,40,39,39,65,66,65,66,65,66,65,66,65,66,921	46	4690 DATA 208,228,169,99,133,187,169,157,133,188,169,3,133,183,169,0,2328
C4	4480 DATA 32,40,32,32,66,65,66,66,65,66,65,66,65,66,65,66,923	23	4590 DATA 65,66,68,39,39,32,32,32,66,65,66,65,66,73,74,65,913	88	4700 DATA 133,185,160,0,185,51,157,240,6,32,210,255,200,208,245,32,2299
5A	4490 DATA 68,39,32,39,32,39,65,66,65,66,66,65,66,73,74,65,920	D1	4600 DATA 73,74,66,66,68,39,39,39,32,40,65,66,65,66,66,65,929	C7	4710 DATA 207,255,240,251,201,49,240,4,201,56,48,230,41,15,133,186,2357
C9	4500 DATA 66,65,68,32,40,32,39,32,66,65,66,65,66,65,66,65,898	BE	4610 DATA 65,65,65,65,65,66,68,40,40,32,40,32,65,65,66,65,905	D3	4720 DATA 76,234,245,147,17,17,73,78,80,85,84,32,68,69,86,73,1464
B5	4510 DATA 65,66,65,66,68,39,39,39,32,39,65,66,65,66,65,66,65,911	86	4620 DATA 65,66,65,66,65,66,66,65,68,32,39,40,32,39,66,66,906	EB	4730 DATA 67,69,32,78,85,77,66,69,82,13,17,67,65,83,61,49,980
F3	4520 DATA 65,66,66,65,66,66,68,39,32,40,39,32,66,65,66,65,907	BD	4630 DATA 65,65,66,66,66,65,66,66,65,66,68,39,39,39,32,32,905	57	4740 DATA 32,47,32,68,73,83,75,61,32,56,32,79,82,32,57,58,899
30	4530 DATA 66,65,66,66,65,66,66,65,68,32,39,39,32,32,65,66,898	C1	4640 DATA 66,65,66,65,66,65,66,66,65,66,66,65,68,40,39,39,973	82	4750 DATA 45,32,0,87,84,51,0,0,0,0,0,0,0,0,0,0,299
		65	4650 DATA 32,40,65,66,65,66,	7A	4760 DATA 0,0,0,255,255,255,255,0,0,0,0,0,0,0,0,0,1020

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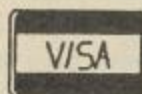
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B A E A K

### Bug Finder

We'd like to remind our readers that we run a Bug Finder service.

If you have typed in one of our programs and despite much checking, you still can't get it to run, then send us the following:

Two copies of your program on tape or disk.

A description of your problem.

If possible a listing of your work (you may omit this).

A stamped, self-addressed envelope for return of the program to you.

Should any of the above be missing then we will not be able to deal with your query.

We will try to point out where you have made errors and place a corrected copy of the program back on to your tape or disk before we return it to you.

Do not send a program to us as soon as it stops working, please check it several times first.

We do get a large number of queries and so it may take a while for us to deal with yours personally.

**Note:** we can only deal with problems relating to programs published in *Your Commodore*.

### Readers Problems

Though the Commodore 64 is one of the world's most popular microcomputers, it can be very difficult to find specific information about your particular machine.

At the *Your Commodore* office we receive literally hundreds of letters from you, our readers, on a wide range of subjects ranging from the simple 'Can you give me the telephone number for ...', to the more complex 'I'm trying to write a program that uses a split screen. How do I do it?'

Unfortunately, the volume of mail received has become so great that it is impossible to answer every letter and still manage to publish a magazine each month.

For this reason we have felt it necessary to produce a number of guidelines for getting information from us.

1) We cannot guarantee to answer every letter sent to the magazine. Should it become apparent that a number of readers are suffering from the same problem, then we will reply to the letter via the Letters page.

2) A new helpline has been set up. This will be open for your queries on

Tuesday and Thursday afternoons between 2.00pm and 4.00pm. We will not be able to deal with your telephone queries at any other time. If our technical adviser is not available when you ring, then a message will be taken

3) If you are having problems with one of our listings, can you please let us know in writing. This will enable us to see if a number of people are having the same problem. When a common problem becomes apparent with a program, then a correction sheet will be issued. Enclose a self-addressed, stamped envelope and we will send you a copy of the correction sheet as soon as it is available.

We are sorry that it has become necessary to instigate these rules. However, we are sure that you will agree with us that the more time that we can spend making *Your Commodore* the most informative magazine around, the better.

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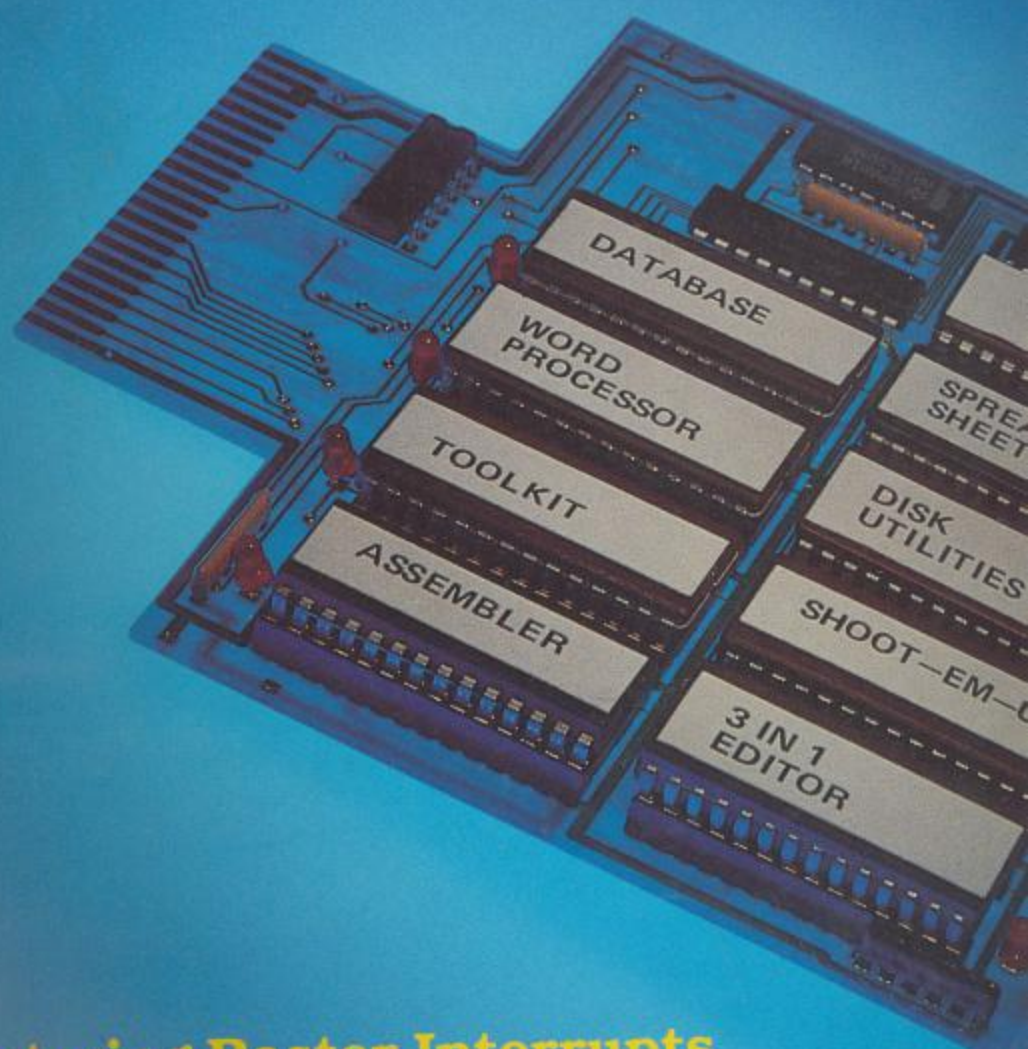
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